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B. BURGESS, CAPTAIN,
Secretary.

WHITEHALL YARD,
10th June, 1884.

NOTE.

With reference to the footnote on page 183, No. 123, of the Journal, it should have been stated that the Essays of Commander Kingscote, Captain R. H. Harris, and Captain Cleveland were honourably mentioned, and that the Essay of the latter Officer was recommended to be printed.



The Journal
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Friday, January 25, 1884.

MAJOR-GENERAL SIR FREDERIC J. GOLDSMID, K.C.S.I., C.B.,
in the Chair.

THE RUSSIANS ON THE CASPIAN AND BLACK SEAS.

By R. CUST, Esq., Hon. Sec. Royal Asiatic Society.

IN the beginning of the year 1883 I heard that the railway from Tiflis to Bakú, on the Caspian Sea, was open to traffic. A few months later I met Mrs. Charles Stewart, who had accompanied her husband, Colonel Charles Stewart, as far as Bakú on his road to Meshed. She had returned to England by steamer to Astrakhan, and up the Volga, thence to St. Petersburg. I had long projected a trip to the Caucasus, and had an exceedingly great desire to see the great inland sea. My mind was now made up, and, accompanied by my wife, I started on the 13th of September, 1883, accomplished my programme in great comfort, and found myself back in London on November 2. So the trip occupied seven weeks, and cost just 200*l.* for two persons.

My route was nearly the direct one, *vid* Berlin and Warsaw to Odessa, and so timed as to hit off the steamer which goes so many times a week to Sebastopol. At Sebastopol I occupied the interval between the arrival and departure of successive steamers by visiting Cathcart Hill, Balaclava, Inkerman, and the Alma, and inspecting the operations of General Conolly and Vice-Consul Harford in removing the monuments. I drove by the celebrated Baida Valley route to Yalta, where I went on board the steamer, visited Kaffa, Kertch, coasted the Caucasus Mountains, touched at Sukhum Kale in Akkhasia, and reached Batúm, the terminus of the new railway from Tiflis, in time to catch the morning train, and reach Tiflis that night in a run of fifteen hours. I was peculiarly lucky, as the branch to Batúm had only been opened in the autumn of 1883, and I was saved the annoyance of going to Poti, which would have entailed delay and the risk of fever.

From Tiflis a pleasant run of twenty-one hours took me to Bakú on the Caspian. The Russian railways are admirable; my fellow travellers were most agreeable; the climate at that season of the

year was faultless; my passport was never asked for; the police gave no trouble. Civility, and something more, kindness, are what the stranger uniformly finds in Russia. I returned along the coast of Asia Minor to Constantinople, thence to Varna, Bučarest, Buda-Pesth, Vienna, to England.

My object was twofold: I. To get some more particular information regarding the languages spoken in the Caucasus Province; II. To study on the spot the problem of the possible occupation by the Russians of Herat. I disclaim all Russophobia, and the least particle of antipathy to Russia. I look upon that great Power as a fellow worker with England in the civilization of Asia; still, when great interests are at stake, it is well to know what our friends and our neighbours are about, however kindly intended and unselfish they may be, or pretend to be.

The problem of the invasion of India by some Power westward of the River Indus has been before me ever since I was sent forty years ago by the late Lord Ellenborough, Governor-General of India, to the north-west frontier of India in the Political Department. The first Afghan war was just over, and I met all the men who had taken part in that war and lived in intimacy with Havelock and Broadfoot; then suddenly the Sikh war burst upon us, and I was with Hardinge and Gough when Lahore was taken in 1846, and in the Punjab fighting to keep possession of my own district, when our frontier was in 1849 pushed on beyond the River Indus to the foot of the Afghan Mountains. In those days we thought little of Russia, though Count Soltikoff was moving about in our midst, for many hundred leagues spread betwixt our advanced frontier and that of the Russians.

But after the Crimean War Russia, just what France is doing now, began a series of petty campaigns eastwards as if to compensate herself from her weaker Asiatic neighbours for the serious defeats which she had experienced at the hands of her European rivals. She first disposed of Schamyl, and made herself entirely mistress of the Caucasus range, thus rendering Cis- and Trans-Caucasia for the first time a compact Province extending from the Black to the Caspian Seas, and a basis of invasion both of Persia and Turkey in Asia. But we shall see further on that the Caucasus Province was intended to be the basis for something more than this, at least it has proved to be so.

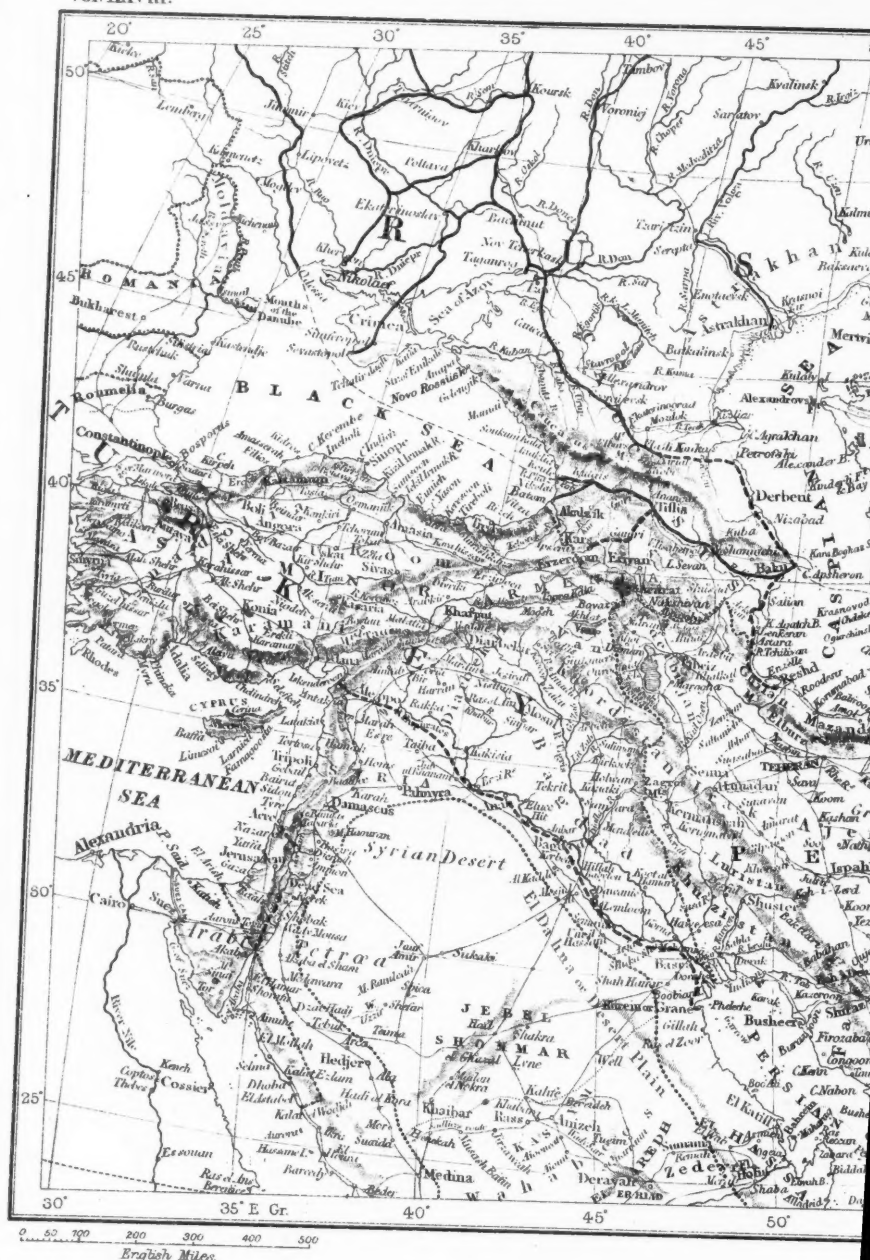
In 1864 Russia extended her frontier into the basin of the Sir Darya or Jaxartes, and occupied Tashkend. This led on to the entire subjugation of the Khanate of Kokand, and the effectual intimidation of the Khanates of Khiva and Bokhara. This brought the Russian frontier into immediate proximity with that of Afghanistan, which now, as ever has been, considered as part of the Indian polity or influence. Very little sympathy was felt for such petty States as Khiva, Bokhara, and Kokand, and Russia did good service in taming or extinguishing them. Yet India could not look on unmoved, and, when Kaufmann in 1878 collected an army at Tashkend to make a demonstration against British India at the very moment of the Berlin Congress, it was felt that the mask was dropped. If in a game of chess the player lays his finger on a piece, even if he does not move it, his policy

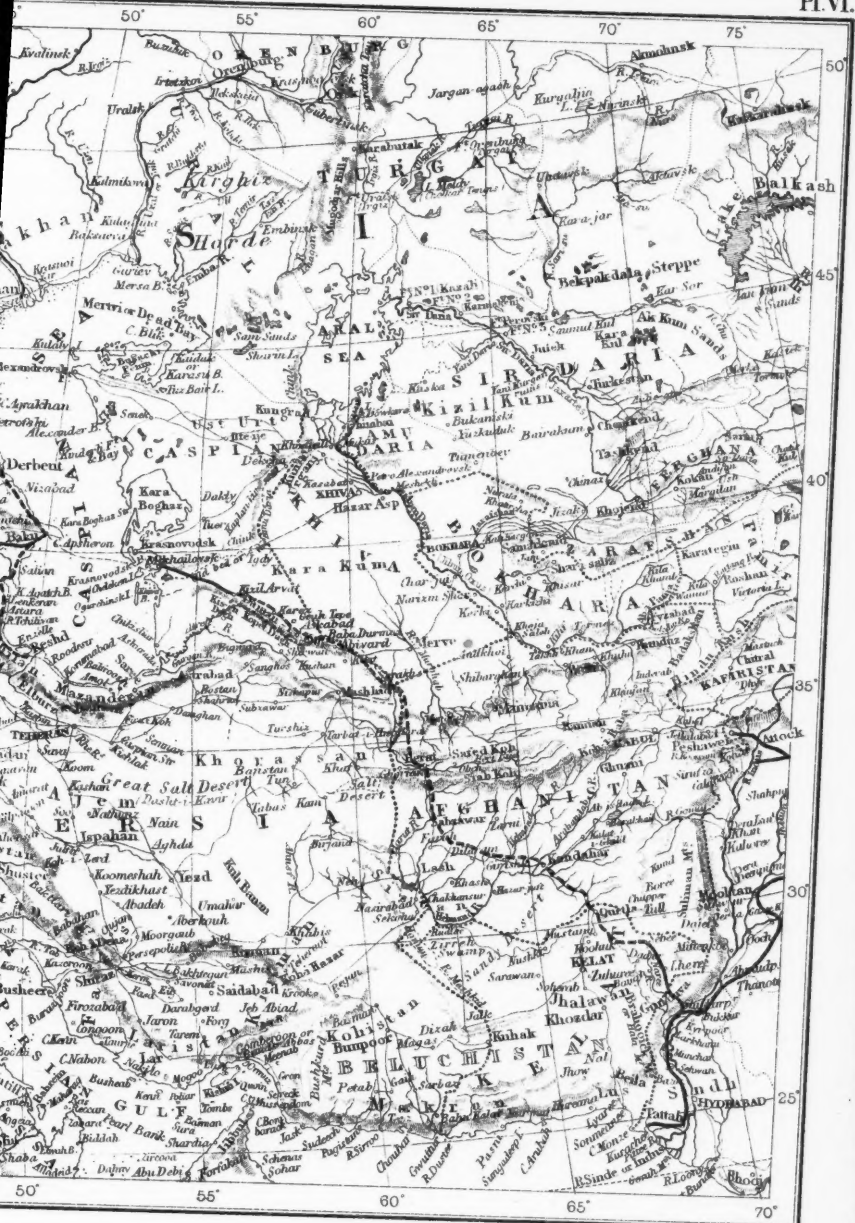
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is disclosed to his adversary. Thus Kaufmann's menace, though only a menace, showed clearly that British India was the quarter in which Russia intended hereafter to operate if brought into collision with England. The distance of Tashkend from Russia proper, and the all but impossibility of connecting it by a railway, was one factor in the problem which had to be considered. The lofty barrier of the Hindu Kúsh was another; it had, however, in past time been surmounted by many an invader of India, and, as a fact, a portion of Afghan territory lay beyond it.

Suddenly, however, the basis of operations was shifted from the Sir Daria to the Caspian Sea, and the eyes of those who watched the game saw clearly that Russia had an easier way to operate upon India than by the River Oxus and the Hindu Kúsh, and each year has made this fact clearer, and this is the object of my present communication. The matter is not new to the inner circle of experts, and to those who have studied the subject, but it is not so well known to the general public as it should be. The last link of the chain was forged when at the end of 1882 the railway was opened from Tiflis to Bakú. Let me first draw your attention to the geographical features of the region, and then treat the subject in detail.

No one is unaware that the resources of Russia on the north coast of the Black Sea are unlimited in magnitude. That is the first section of the subject. The next section is the Caucasus Province, the existence of which is generally known, but the potentialities and the capabilities of the Russian power in that province are not so well known. The third section is the Caspian Sea; I shall proceed to show what a fleet of steamers are collected on these waters. The fourth section is the Trans-Caspian Province of Russia traversed by a railway as far as Kizil Arvat, and by a good road as far as the "frontier at this moment," Baba Durmaz. It is proposed to construct a railway as far as Geok Tépé. In a few months, or even while I am speaking, that frontier line may be pushed forward. The fifth section is the line of country from the Russian frontier through Sarakhs to the Hari Rúd River, where unquestionably Afghan territory, and, as above stated, the influence of British India commences. The sixth section is the country betwixt the Hari Rúd and Herat, the district of Badgheis. This region has only been revealed to us last year. Beyond Herat we are at home, and the interior of our own house is known to all of us.

During the Crimean War the weakness of Russia was exposed by her inability to bring her resources of men and material to the front, from the absence of military roads and railroads. As regards the Black Sea she has cured that defect now. She still has the incurable defect of the whole line of her coast, with the exception of the Crimea, being bound by a frozen sea for a certain time in the winter. At Odessa last winter the residents walked round the big ships frozen in the harbour. Odessa, Nicolaef, and Sebastopol on the Black Sea, Taganrog and Rostof on the Sea of Azof, are linked by a network of railways to every part of the Empire.

At Kertch, which is the door of the Sea of Azof, under the direc-

tion of Todleben a most formidable fortification has been constructed, under the guns of which every vessel entering the Sea of Azof must pass. In the Black Sea are the excellent steamers—large and commodious—of the Russian Navigation Company, all built at Newcastle and on the Clyde, but the docks of Sebastopol have once more resumed their activity. At Odessa, Sebastopol, and Batúm the steamers on arrival lie flush up to the pier, an obvious convenience in embarking and disembarking troops.

The transit from Odessa to Batúm occupies four days, and from Sebastopol three days, calling at all the ports; but a direct transit across the Black Sea would occupy only half the time. Of course the navigation of the Black Sea presupposes the absence of a superior hostile fleet; in that case not only the transports could not cross, but the last 5 miles of railroad from Tiflis to Batúm runs along a low shore, and could be rendered impassable by a gunboat. It is in time of peace only that the Caucasian province can be reinforced from the side of the Black Sea. It is proposed to construct a branch railway from the Rostof-Vladikafkas line to Novo Russik, on the Black Sea, which would enable reinforcements to be sent from the interior of Russia to the military posts on the Black Sea at a time when the Sea of Azof is obstructed by ice.

Let us now consider the second section—the Province of the Caucasus. It embraces the whole of the Caucasus mountain range from sea to sea, the Steppe region to the north of that range, and the region of Trans-Caucasia, south of that range, the frontier of which marches with the frontiers of Turkey and Persia; the three kingdoms touch each other at Mount Ararat. The Province is divided into Cis-Caucasia and Trans-Caucasia, and is entirely subdued. The population is as entirely alien from the Russian nation as the people of British India are from the English. It consists of Georgians, Armenians, Kurds, Turks, and a host of mountainous tribes of very different races and languages. The strength of the army of the Caucasus Province, without the reserve, may be taken as from 60,000 to 70,000 effective men. The reserve would raise it to 120,000, and the bands of irregular Georgian cavalry and infantry, which are called out in war-time, to 30,000 more. Every military cantonment comprises a military colony, to which every soldier, after completing his term of service (five years), can retire. These settlements are extending annually, and materially strengthen the Russian hold on the country. To the above available force must be added the Cossacks, who can turn out 50,000 horsemen, most useful cavalry for Asiatic campaigning. This information is supplied by a competent authority only last year. There is no fear of invasion spontaneously from the side of Turkey or Persia, as both those effete and moribund Powers are anxious to be let alone, and can only be induced to strike when it comes to be a struggle for dear life. In the last war Turkey invaded the Caucasus Province with a view to create a diversion in what seemed to be a death-struggle.

In addition to this effective force in the province reinforcements to any extent can be sent to Vladikafkas, north of the Caucasus range,

which is in railway connection with every part of the Empire. Except in winter, a mountain road over a pass of 8,000 feet is open to troops by the Dariel Pass, through an entirely pacified district; and in a few years one of two schemes will surely be carried out—either a railroad through the Dariel Pass, which would be a small affair compared to that of Mont Cenis or Mont Gothard, or a railway of greater length and easier construction skirting the northern flank of the range eastward to the Caspian, at Petrofsk, thus supplying a new feeder of troops for the Trans-Caspian province, and then running on the shore of the Caspian through Derbend to Bakú, the eastward terminus of the Tiflis railroad to the Caspian. In either case unlimited reinforcements could be speedily sent to the Trans-Caucasus army, *under all circumstances and at all seasons*. Except in winter, reinforcements could also be sent from Astrakhan by sea to Bakú or Michaelovsk, but the mouth of the Volga is frozen for many months.

In the "Times" of last month appears the following notice from St. Petersburg, dated December 26, 1883: "An Imperial Decree orders the reorganization of the local troops of the Caucasus and the formation of six battalions of reserve." It reads very much as being an order analogous to the annual relief in British India, but such an order might mean the detachment of a corps d'armée of 20,000 picked men by railroad from Tiflis to Bakú in twenty-one hours. There is no English Consular Agent at Tiflis or Bakú, and this military movement might attract no attention; there are vast open spaces eastward of Tiflis, and it might be presumed that this corps d'armée had been detached for autumnal manœuvres and ball practice. What would become of that corps d'armée on its arrival at Bakú we shall see in the third section.

The third section is the Caspian Sea, but it includes the great and rising city of Bakú, the eastward terminus of the Trans-Caucasus Railway. Bakú is a name of which we shall hear more in the next quarter of a century. Nearly exactly opposite to it, on the other side of the Caspian Sea, but within twenty-four hours' steaming distance, is Michaelovsk, the terminus of the Trans-Caspian Railway, which now proudly takes its place in the railway books of the Russian Empire, though I have never met anyone who had travelled by it, nor did the Imperial railway inspector who by chance accompanied me to Bakú venture across to look at it; there is no question but that it exists, but for strictly military and aggressive purposes.

Bakú is the centre and the port of the inexhaustible petroleum wells, which are destined to flood the world with kerosine. It is one of the wonders of the world, for the supply is on the surface, and when a well is tapped the liquid leaps 40 feet high in the air; it bursts up through the sea, and one of the things to be done by a visitor is to go out in a boat and set the sea on fire. The fire-worshippers who used to worship the deity here in the form of a flame of naphtha, are fairly driven out by the commercial use to which their divinity is put in modern times, for the oil is admirable and universally useful; it is proposed to construct a pipe of the length of 500 miles to convey it to the Black Sea. The refuse, after refining,

supplies fuel for the steamers and railway cheaper and better than coal. The railway carries countless oil-tanks, of the appearance of great elephants, to Tiflis, and the Caspian is full of steamers to convey the oil in vast tanks to Astrakhan and up the Volga. The mouths of the Volga have the drawback of being frozen in the winter, but Bakú is outside the limit of severe winter, and the Russian Government finds itself, to its own astonishment, supplied with an unlimited number of steamers, not kept idle or collected at a great distance, but always available to leave off carrying petroleum, and carry across the Caspian in twenty-four hours the corps d'armée above alluded to at Michaelovsk. In addition to the petroleum steamers is the Imperial Fleet of war steamers, and the fleet of the Caucasus and Mercury Company, which run betwixt Bakú and the Volga.

Only a few weeks ago I was at Bakú, and these thoughts assumed upon the spot a much greater idea of reality than it is possible to give to them by pointing out the place on a map. The trains always arrive late at night, and the effect of the light burning on the petroleum field is strange and imposing. Early next morning I hurried down to the dock, and stepped from the pier on to a steamer just about to start for Astrakhan. Before me lay the great mysterious Russian salt lake, the greatest internal sea in the world, and the one on which no flag but the Russian can fly. Beyond, in the unseen distance, was the mysterious Trans-Caspian territory, and the new road to India. I had been one of the first forty-two years ago to cross the Isthmus of Suez on the then new route to India, and I wished that I was younger, and could cross to Michaelovsk, and work my way to Sarakhs. While I was on board, a steamer came into sight hailing from Resht, Asterabad, and Michaelovsk. I was delighted to hear around me the well-known Persian language once more spoken, and I thought of the anecdote of the Emperor Trajan, who saw the ships from India coming into the harbour at the mouths of the Euphrates, and wished that he was young enough to go to that unknown country. Two Frenchmen landed from that steamer, who had accomplished a marvellous journey from Pekin, through Siberia and Trans-Caspian Turkestan. They had ridden from Khiva to Merv, and from Merv to Meshed, without let or hindrance from the Turkomans, who a few years ago would have killed them, or sold them into bondage. So mighty has been the change worked by the storming of Geok Tépé by Skobelev. I asked the travellers how they managed to work their way from Khiva to Merv, and Merv to Meshed. They attributed it entirely to their skill in managing natives, in which Russians and English were so deficient, according to them. I then asked them what language they made use of, and found that they knew nothing but French, and had not even a personal servant nor an interpreter; they had been shot through by the Governor of Khiva like pellets through a pop-gun. At any rate there can be no doubt that at any given moment, without a note of preparation, a corps d'armée, brought in one day from Tiflis to Bakú, could, the next day, be shipped across to Michaelovsk.

The fourth section, or the Trans-Caspian Province of Russia, is partly traversed by a railway, 144 miles in length; the time occupied being twelve hours. The country is perfectly level, and uninfested by hostile tribes; but a desert, and devoid of human habitation. This work is entirely due to the energy and ability of General Annenkoff, the Controller of Russian Military Transport under General Skobelev, who suggested and carried out the design of a railway from the Caspian to the Tekke oasis at Kizil Arvat. There happened to be 100 miles of rails lying unused at Bender, on the Danube, purchased for use during the Turkish War. This material was shipped to Poti, carried by rail to Tiflis, dragged on carts and camels to Bakú shipped to Michaelovsk, and, in spite of the lukewarmness of the Russian Government, and the ridicule of those who were ignorant or jealous, or both, laid down and materially assisted Skobelev in his campaign. This was the first sod turned of a line destined before long to extend to Herat, and link itself to the railway system of British India. Whatever may be the results, the Emperor and his Ministers at St. Petersburg are by no means responsible for the wonderful and unexpected supply of steamers and railway that connect Bakú with Kizil Arvat. The railway ends there, and it is an error to suppose that either railway or tramway extends further. Baba Durmaz, 47 miles south-east of Askabad, and a deserted village, is the frontier of Russia on the 1st January, 1884. However, among the railway projects actually under the consideration of the Governor of the Caucasus is the extension of the line from Kizil Arvat to Geok Tépé.

The fifth section extends along a debatable land claimed by the King of Persia, but until the taking of Geok Tépé, which is called also Yenge Sheher, overrun by Turkoman hordes, whom it was beyond the power of the Persian Government to control. A great change has come over both the Akhal Tekke and the Merv Tekke, and the King of Persia is indirectly indebted to the victory of Russia for the opportunity of reasserting his authority. By a treaty with Persia, dated 1880, the Russians have for the time accepted a boundary, and there is no reason to suppose that the Turkomans, who are so cowed, will give them any excuse for moving on, but, if they did, the Russians would unquestionably refuse to acknowledge the sovereignty of Persia over this section, though they scarcely could ignore the authority permanently established at Sarakhs. In the newspapers of yesterday appeared a quotation from the "Caspi," a Russian local organ, to the effect that a Turkoman raid had taken place last week from Merv on Meshed. This may be true or false, but the result will be the same, that the railroad will be pushed on to the Russian frontier, or even extended to Sarakhs, for the *purpose of protecting the Persian kingdom*. Moreover, the General commanding did not hesitate to send forward a competent surveyor, Lessar, to take the levels for a railroad to Sarakhs, which is actually on the Hari Rúd, or Herat River, though known there as the Tejend, or Sarakhs Daria. General MacGregor, from India, had reached this town coming from the East, so here the advanced line of the Russians touched the advanced line of the English. And a little to the west of this town the regular estab-

lished road from Meshed to Merv, which is only 90 miles distant, is crossed. Sarakhs is occupied by a battalion of Persian infantry, and is a large fortress, but the astute surveyor remarks that it is quite possible to carry the line at such a distance north of the fortress as practically to be independent of it.

The sixth section, as stated above, is according to the opinion of the highest English authority within the recognized territory of Afghanistan, as distinguished from Khorasan, which belongs to Persia, and the free country of the Turkoman tribes. And yet the Russian General had the boldness to send his surveyor across the Hari Rûd River into this Province, and survey a line for the railway up to the walls of Herat, showing professionally that there is no impediment whatever of a physical character, and no elevation to be traversed of more than 900 feet, and no opposition from the tribes occupying the country.

Summing up the whole distance from Michaelovsk, the basis on the Caspian, to Herat, "the Gate of India," we have the following ascertained distances:—

	English miles.
Michaelovsk to Kizil Arvat..	147 (railroad)
Kizil Arvat to Askabad.....	135 (road, railroad proposed)
Askabad to Sarakhs	185
Sarakhs to Herat	202
	<hr/> 669

Of this distance nearly one-half lies within Russian territory, the remainder may be deemed *de facto* debatable land, until the neighbourhood is reached of Herat, but *de jure* Afghanistan is bounded by the Hari Rûd.

There is little reason for doubt that the corps d'armée which I left at Michaelovsk could occupy Herat long before any force from British India could reach it; Herat is distant 599 miles from Sibi, the terminus of the Indian railway system, and 522 miles from Kizil Arvat, the terminus of the Russian system, but the two roads are not equally open to an invading army; the Indian army would have to fight its way.

But the dazzling bait is held out of a railway to India with only two short breaks of the land route, viz., two days on the Black Sea, and one on the Caspian; the whole distance is to be traversed in nine days by linking on the railways of India extended westward to Herat. It has even been suggested that our annual military reliefs might be sent by this expeditious route, or in other words that we should place our heads in the mouth of the lion.

Let me not be mistaken; the occupation of Herat is not synonymous with the occupation of British India; nor has Herat been occupied yet, nor, except as a diversion in time of a European war, does its occupation come into the sphere of practical politics, and many a banner will be rent, and many a warrior will lick the dust, before a Russian crosses the River Indus. Still the mere occupation of Herat

by a Power from the West would be an incalculable misfortune, for the report would circulate in an exaggerated form in every bazaar throughout British India, and that feeling of quiet—the *Pax Romana*—which has so long existed, will have passed away for ever. Nor would the conterminous existence of a great European Power, even if peaceably inclined, be other than a misfortune. At present India is isolated, shut in by the sea and mountain ranges, with no desire to penetrate, or have any relations beyond. The necessity of keeping up a great frontier army would be a burden beyond the resources of the State Revenue in a country where military conscription is impossible. One thing, however, may be said on the other side, that the burden of military service at such a distance from his home would become intolerable to the Russian conscript soldier also, and to a country with such a critical state of internal politics, and such a bankrupt exchequer, so vast an extent of frontier would be a great element of danger.

A great authority in 1875 impressed upon us that there was one point, which was the pivot of the whole Eastern question, and which must never be lost sight of, viz.: "We cannot afford to expose Herat to the risk of being taken by a Russian *coup de main*." And yet this is the precise point at which in 1884 we have arrived; over and over again we were assured by geographers and politicians that a range of mountains lay between Herat and Sarakhs. General MacGregor told us in 1875 from his careful enquiries that such was not the case, and in 1882 we have the fact confirmed by the personal inspection of the Russian surveyor, Lessar. In the same year the railroad is opened from Tiflis to Bakú, reducing a long tedious march of many days to a few hours.

It has been asserted that successful war is absolutely necessary to keep the patriotic steam of the Russian at high pressure, and that without it the Imperial machine would stop, as the military influence is paramount, and soldiers desire honours, wealth, advancement; but against this assertion must be stated the positive fact that the advance of the Russians into the territory beyond the Caspian has been an unmixed blessing to humanity. Greater scoundrels than the Turkomans and Uzbeks can scarcely be imagined. The evidence of this can be collected from English and Persian witnesses. The most abominable system of slavery, and armed raids for plunder and murder, have been put a stop to over extensive regions. Fertile districts long laid waste will now be occupied again by peaceful inhabitants. The ferocious habits of the Persian and Turkoman frontagers will be abandoned. To the conquest of Bokhara and the taking of Geok Tépe, the change must be attributed.

The English, as well as the Russians, are governed in the East by an uncontrollable tendency to advance, in spite of the most unaffected and positive orders of the Governments of the Queen and the Emperor not to move forward, and in spite of their attempts to suppress the causes leading to the forward movement. Those who have been acquainted with British India for the last forty years know such to be the fact. The Imperial Government has found itself disobeyed in the

same way by over-zealous servants. The conquerors of Sind and the Punjab can hardly throw dirt against the conqueror of the Khanates and Trans-Caspia. England and Russia, driven by some kind of mysterious necessity, have been yearly approaching nearer and nearer to each other, and now that the time of their actually meeting is very near indeed, the question arises whether it should not take place on the peaceful ground of commerce and international intercourse, which would be advantageous to both parties. At any rate, by no conceivable policy can it much longer be avoided. It may be regarded as one of the coming events which throw a shadow over the next quarter of a century. If remonstrances were made at St. Petersburg against a further advance, it would be met by an assurance that no advance was intended; and yet it would be made; if threats were made, the advance would only be accelerated.

It is proposed to construct two new railways from Tiflis: one to Kars in the newly annexed Turkish province, to be eventually extended to Erzurum; another is or has been talked about to Julfa, on the Araxes, the Persian frontier, to be eventually extended to Tabriz and Teheran. I went over the maps, and the elevated plans of the Province of the Caucasus and the adjoining territories, at the Topographical Office at Tiflis, under the guidance of the most obliging head of the department. There was no pretence of secrecy, or occasion for it, and the Turk and Persian must feel at any moment that the Russian is walking on their graves. All is ready for the advance, and the specious pretence of the extension of legitimate commerce is not wanting to palliate or justify a forward policy.

But this argument applies still more as regards the advance of railway communication towards India. The time has come when commerce must return to its old route through mid-Asia. This great central route was traversed by the great Arian nations on their migration westwards, and by all the great conquerors from the time of Alexander the Great. Is it of any use our attempting to oppose it? Lord Palmerston did very little good in opposing the Suez Canal. We should rise above our position as mere Englishmen and look to the general interests of mankind. We are always impressing this lesson on Portugal, that she should not be like a dog in the manger as regards her so-called colonies in East and West Africa, and try to keep other nations from the Kongo. We must practise our own precepts, and accept the inevitable of the direct railways through Central Asia to India. The danger to our Indian Empire may be a question of doubt, but about our duty to assist the pacification of these lawless districts, and promote a railway which could convey passengers from India to London in nine days, there can be no doubt. It would be of no use opposing such a scheme, nor would it be worthy of us.

And in the meantime let some of our younger Officers go out to the Caspian, and do what I did not do—cross over, and make themselves familiar with these regions, no longer sealed up. All the advantages of new and unexpected combinations of circumstances are not always

on one side. History warns us of the danger of attempting to grasp at universal dominion on the part of any one State. We should be playing into the hands of our rival if from a selfish fear of injury to our limited interests in British India we opposed what is clearly to the advantage of Asia and the world generally, to bring back peace, civilization, and commerce into the region east of the Caspian and south of the River Oxus. The work will be done, whether we like it or not.

P.S.—To those who wish to follow up the subject, I indicate the following books:—

- I. "England and Russia in the East," 1875, and subsequent contributions to periodicals, by Sir Henry Rawlinson.
- II. "Journey through Khorasan," by Sir C. MacGregor. 1875.
- III. "Tour in Khorasan," by Captain Napier. Proceedings of Royal Geographical Society. 1879.
- IV. "Merv Oasis." O'Donovan. 1882.
- V. "Clouds in the East." Valentine Baker. 1876.
- VI. "The Russians at Merv and Herat." Marvin. 1883.

The CHAIRMAN: Mr. Cust has opened with great efficiency a subject which a very few years ago was a very popular one, and one on which many gentlemen, and probably amongst them some who are here present, had a great deal to say. We have not had much to do of late years with the Russian question, but perhaps those who feel an interest in it will say a few words on the very interesting paper we have just heard.

Captain BEDFORD PIM, R.N.: I am sorry that it should be left to a sailor to open this debate. There are gallant Officers present who have been all over India, and have spent the best part of their lives there, and I should have thought they would have come to the front at once; but I am particularly anxious to thank Mr. Cust for his paper, because it warms my heart when, in the opening lines of that paper, he shows that the good old spirit of enterprise of the real Britisher is still existent. I thought it had died out, but when I see that Mr. Cust and his wife go off to Bakú without making any difficulty at all, I hope it will be a stimulus to younger men to do likewise. I must confess I do not feel the terror of the Russian advance across any of the passes leading into British India which many persons experience. I suppose you will say there is "nothing like leather" when I tell you my idea is that the attack of the Russians will be most decidedly against the English—for it is coming, of that there is no doubt!—by sea. We all know that Russia has a very fine port, though it is blockaded by ice a great many months in the year, at Petropaulovski. I remember when I was there, the Russian Commandant asked the Captain of the frigate I was serving in to be good enough to lend his crew to help in placing some guns in position. I need not tell you that the late Admiral Kellet did not accede to that request. And it was very fortunate, perhaps, that he did not, because, seven years afterwards, I suppose those very guns were used against us when the combined French and English squadrons attacked Petropaulovski. But Russia, not content with Petropaulovski and the Amoor, went still further south, and I know that she has now at Vladivostok, or rather Peter the Great's Bay, a constellation of ports unequalled in the whole world, and within only four days' sail of Hong Kong. Nothing can be more dangerous than such a position as that, excepting this, perhaps, that I see by the "Standard" of the 17th of this month, a road is being made which will place Resht, by way of Teheran, in direct communication with the mouths of the Euphrates. These are the words, and you, Sir, will no doubt know the whole route well: "The Shah has ordered in Prussia three river steamers for the Karun, two to ply below and one above the Ahwaz rapids, thus connecting Shuster with Mohammerah by steam

navigation. From Shuster a carriage road is to be made by a Persian company through Khorremabad and Burujird to Koom, whence a road has already been nearly completed to Teheran." Of course, if this road is completed nothing will be more easy than for the Russians to run a railway down there, which if done *before* our through line to India *via* Euphrates, Persia, and Beloochistan to Kurachi reaches Persia, will effectually bar our crossing the Russian line without their permission. Once allow the Russians to have another seaboard outlet which can be made another Sebastopol, in such a commanding position as the Persian Gulf, and I think Russia need not attempt to attack India by way of the Bolan Pass, Quetta, Pishin, or any of the passes to the Indus: she could cut our communications with our Indian possessions at once with the greatest possible ease. We know also that the 11th Clause of the Treaty of Paris has now been torn up, and the Black Sea is practically a Russian lake. By the genius of Lord Palmerston it was made a neutral sea, but unfortunately that clause has been eliminated from the Treaty of Paris, and now Russia has another outlet. And I need not tell you she has also the outlet in the extreme western part of her dominions in the Baltic. Russian policy is really to push down southward and command what every writer and every thinking man from the most ancient times knows perfectly well is the great thing to possess, namely, the "command of the seas," and Russia, in my opinion, is determined upon possessing the "command of the seas." Sir Walter Raleigh said, "He who commands the seas commands the trade of the world; he who commands the trade of the world commands the riches of the world, and, consequently, the world itself." So that you can quite see, by the direction in which Russia is moving now, what, in my humble opinion, her real object is. I am very sorry to differ from Mr. Cust in the remotest degree, but I simply take the question from the sailor's point of view. I am not interfering with the soldier's point of view. Undoubtedly the soldier's point of view is to have some jolly good fighting, and that would be in a land attack by Russia, with her troops against the British troops. It is a very difficult thing indeed to "knuckle down," as we should say, to the plan put forward by Mr. Cust. He wants us to shake hands at Herat with Russia, for us to build the line from Sibi to Herat, for the Russians to build the line from Kizil Arvat to Herat, and to meet there, and to be very good friends indeed. I really do not see how you are going to do that sort of thing; at all events, the advice is not the advice which would have been given to us in this theatre twenty-five years ago. We should have been rather more inclined to advise that we should fight for it, but, in these wonderful days, it is quite another affair altogether. And it seems to me, perhaps, after all, Mr. Cust may be right; it may be advisable to complete the railway link to India, if only we can induce Russia to enter into a Treaty with us that if we do join with her in building a railway from Sibi to Herat to meet her line from Kizil Arvat to Herat, that then her ports shall be thrown open to our commerce, precisely the same as our ports are now thrown open to hers. We are a free-trading nation, Russia is strictly protective—every mile she advances she takes care to put the whole of the commerce of the country under strictly protective, not to say prohibitive, duties. If we can knock down that barrier, I think we may with safety adopt Mr. Cust's plan, but otherwise I should be very much inclined to think, after all, it would be much better to fight it out, for we shall have to fight it out sooner or later. There are many gentlemen here who have been in India, and who know it from beginning to end, and I do hope that Mr. Cust will not have the bad compliment paid to him of not hearing a really good discussion upon his most admirable paper.

MR. FORGETT, late Commissioner of Police, Bombay: I do not know that I am doing right in taking up your time and the time of the audience, but I shall very briefly state what I have to say. The proposition of the lecturer, for a railway connecting India with Russian territory, with the object of advancing the interests of mankind, is a grand, a poetic idea, and much to be desired, if it could be carried out by both parties in good faith. But it is necessary to take into consideration the political characteristics of Russia, which, from first to last, will be found to have been adverse to British interests. Is it moreover to be expected that two great Powers, co-ordinate in strength, would live together in peace and harmony, divided by merely a conterminous boundary? The annals of

the world afford no such instance of harmony. England had her Heptarchy, and what was the result? They fought on till one became supreme. Then there was Scotland. Did the two kingdoms remain in a state of peace and quiet? No, the conflict continued with all its devastating accompaniments till Scotland became united to England. Take another case. The Russian Emperor, Vladimir the Great, divided his Empire among his twelve sons, and in his dying moments enjoined upon them peacefulness and brotherly love towards each other; but he was no sooner dead than they commenced a civil war and went on fighting till one became supreme. Russia has been, ever since, conquering and advancing, and her object from the time of Peter the Great has been Constantinople and the Black Sea, and to move on in the direction of India. Constantinople he declared to be the key of his back door, and that he must have it for the benefit of his people. And Russian advances in the direction of India, since the Crimean War, have been so great as to cause great apprehensions. The Russian Government were communicated with and it led to the adoption of a very carefully elaborated neutral zone. That zone was, on the Indian side, respected by us, but it was violated by Russia. The expectation that quiet had been secured as regarded India was cast to the winds. When Russian forces were being marched to Khiva, our Government took the alarm and protested; that protest brought Count Schouvaloff to London with the solemn assurances of the Russian Emperor that his object was merely to chastise the Khivan people for the wrongs inflicted on his subjects, and after having inflicted the chastisement to retire, as we had done from Abyssinia. I happened at this time to see Sir Erskine Perry. Mentioning the assurances conveyed by Count Schouvaloff, he asked me if it was not all right with regard to India. "You may think it is all right," I replied, "but in my estimation it is far from being right, because every inch of ground the Russians take they will keep." I need not say that I was laughed at. This fact is stated in my book on "Our real Danger in India," written seven years ago. In that book I have mentioned this interview with Sir Erskine Perry and one with Sir Harry Verney. Every inch of Khivan territory the Russians took they have kept. I then said their next step would be Merv; of Merv they are virtually in possession, and thence they would go on to Herat, towards which they are rapidly converging. Russians established at Herat or its neighbourhood, I have no hesitation in stating, would lead to India becoming demoralized. Up to the present time we have been looked upon as being all-powerful, and therefore the people have remained in a perfect state of subjection even with a number of disturbing tribes amongst them, whom Russian proximity would speedily enliven to disloyalty. The presence of Russians at Herat would prove very disturbing of the quiet of India. The people well know that we are opposed to their advance; that we have sent in protest after protest, and that in defiance of us they are advancing. When Lord Northbrook was Governor-General of India, Prince Frederick of Schleswig-Holstein was travelling through Cashmere, and the Cashmere Prince expressed himself as being very greatly alarmed at the progress Russia was making, so much so that Prince Frederick thought it necessary to write specially on the subject to the Governor-General. You will find this stated in the Blue Books. What was it that led to Shere Ali's disloyalty? He did all he possibly could to impress the Government with the belief that the approach of Russia towards India indicated very great danger. He made known that his anxiety on account of them "would never be removed unless the British Government aided him," and "British Officers commenced forthwith to organize the Afghan troops." What he was anxious for was that they should have reason to know that, in the event of the occasion arising, we would protect him from Russian oppression. But we declined to afford any assurance, and when he found that there was no possibility of inducing us to do anything on his behalf, he threw himself into the arms of the Russians. The fact is, in the event of Russians establishing themselves at Herat, the whole of India would move.²

¹ Actually in possession now.—Ed.

² The immediate object of the Russians is Constantinople, to obtain possession of which their preparations at the present time are so far advanced as to enable them to sweep down, so soon as they have been able, by a concentration upon India, to place

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Captain BEDFORD PIM: Allow me to interpose for one moment. When I was in the House of Commons I had access to endless documents with regard to this question of Russian aggression, and I compiled a little map showing the size and advance of Russia, copies of which I have much pleasure in placing on the table for the acceptance of those present. The map is rather unique in this respect: that running down the meridian of longitude you will find the hour, so that anyone can see at a glance the difference of time between London and any other part of the world in which you are interested.

Sir GEORGE CAMPBELL, M.P.: I am only a stranger and a visitor here, and would rather have listened to great military authorities. This at least I may claim, that perhaps I am the oldest and closest of the friends of Mr. Cust in the room. I have known him all his life, and appreciate his great abilities; I have had very great pleasure in coming here and hearing the most clear and able discourse which he has given us. I confess to some little disappointment that he should so far have joined the ranks of the alarmists. It strikes me he has not shown us how the evils which he anticipates are to be avoided. Perhaps it might have been kinder if he had allowed us of the older generation to sleep quietly in our beds, and leave these terrors to further generations to come, but I am afraid after what we have heard from Mr. Cust we cannot sleep quietly in our beds. He has assured us in solemn tones of the dreadful evils which are coming upon us; but, as I have said, the remedy which he suggests is scarcely one which will stave off these evils; on the contrary, one would suppose that by constructing a railway and facilitating communication between the Russians and ourselves he will hasten that contest which he seems to fear. The difficulty as regards constructing railways is not only

it out of the power of England to thwart them as she has been hitherto doing, and they will not be long in accomplishing that object, if the present policy of the Government of implicit confidence in Russia is continued, and the gathering towards Herat is permitted to proceed without the adoption in Europe of measures of prevention. The loyalty towards England of the Czar and his family is beyond question; but they stand apart from the Russian Generals and those who influence their movements. The difficulties, social as well as financial, in which Russia is now involved, are said to be such as to paralyze all thought, on her part, of war. Social agitation, however, is calculated to become allayed rather than kept alive, by the enterprises of war. And pounds, shillings, and pence, unfortunately, make up the sum of human existence and are, at the same time, most important factors in commerce. Constantinople in the hands of the Russians, the coffers of the world would be thrown open to them. I have heard the exclamation, "Sufficient for the day is the evil thereof." I for one should be sorry to bequeath to our successors a heritage of trouble, if not of dishonour.

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The CHAIRMAN: Perhaps General Abbott will favour us with a few words?

General ABBOTT: I am afraid I cannot address you, having come here wholly unprepared. I may, however, say that I think Russia is formidable only when we give way to her. Whenever we show a determined face, she shrinks back. We have allowed her to gain such advantages that this may now be very difficult; but still I think that to give way to her is the most dangerous of all possible policies.

General Sir HENRY LEFROY: May I be permitted to say one word, partly because I am reluctant that a discussion of this magnitude and interest should take place without any military member, or very few of us, rising to take part in it? As I have never been in India, and have never made even a special study of that part of the world, I perhaps have as little right to speak as any gentlemen who is present; but one thing has struck me in the course of the discussion, that whereas there is nothing so uncertain as political prophecy, there is nothing so certain as the irresistible expansion outwards of nations which have vital forces within them. "All the king's horses and all the king's men" won't prevent England and Russia from meeting in Central Asia, and it is much to be wished that we should hereafter do so. The condition of humanity over that enormous region of the globe has long been such that we must have often shuddered at it, and have longed to see it put an end to; what we learn from history is that these things are put an end to generally by the extension of commerce alone; and it is by the extension of commerce, the completion of this line of rail in one direction, the completion of other lines of rail in other directions, the simultaneous expansion which goes on, not on any one line whatever, but in a variety of directions, that Divine Providence seems to have designed that its ultimate intention of human progress is to be realized without that disturbance of the equilibrium of human affairs which we all of us dread so much, and are apt to exaggerate by our proneness to fix our eyes upon one detail alone.

Captain J. C. COLOMB: A question which I wish to put to the lecturer is this: Can he give us any particulars with regard to the number and capacity of these steamers on the Caspian Sea, because his paper without such definite information leads one to conclude that the transportation across the Caspian of 20,000 men is a very easy matter? I dare say the difficulty of obtaining such information is very great, but as it is a matter of considerable importance, I should like to ask if he has any definite information that he can give us with regard to these matters.

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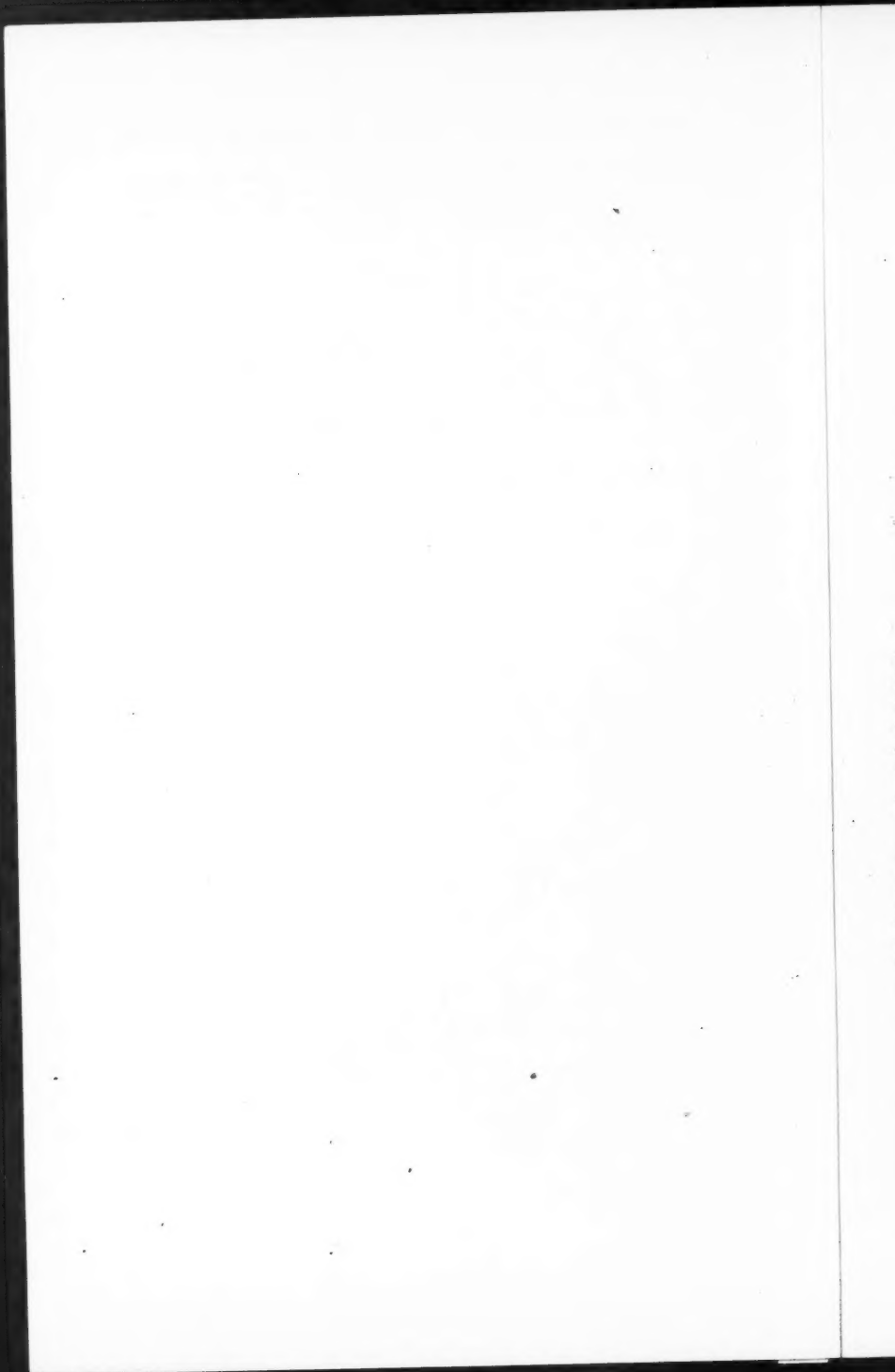
Mr. CUST: There are three classes of steamers on the Caspian. First of all, the Imperial steamers, war steamers with which Russia has kept a police of the Caspian for the last twenty-five years to put down piracy. It used to be a regular nest of pirates, but now there is perfect tranquillity. Secondly, there is the Company called the Caucasus and Mercury, with a very large number of steamers for commercial purposes; they start from Kazan, drop down the Volga, enter the Caspian, and connect that sea with the heart of Russia. They are very numerous and very large. Then I mentioned the considerable number of steamers which have come into existence to carry the petroleum. Each steamer has a capacity sufficient to hold about 500 men. The whole 20,000 need not cross at once. The Russians have a large force already stationed in Trans-Caspia, and twenty-four hours' steaming across would enable them to get considerable reinforcements in the course of a week.

The CHAIRMAN: Gentlemen, I shall not detain you many minutes by anything but I may have to say on this subject. I am tolerably well acquainted with the

countries to which Mr. Cust refers, have been up and down the Caspian four or five times, and made more than one visit to Bakú and its fires. Between 1870 and 1871, however, and 1883, the respective periods of my own and Mr. Cust's journeys, the difference, in the case of a progressive country like Russia, must be very considerable. I therefore cannot myself answer the question put by Captain Colomb as to the number of vessels on the Caspian, but am quite certain that the increase is of a marked character. There were three large passenger steamers and some merchant-vessels in my time, but beyond that I can say nothing. That the progress of Russia is unmistakable, a very simple fact stated by Mr. Cust will show. He mentioned, in the outset of his lecture, that he went by rail from Batúm to Tiflis in fifteen hours. Not sixteen years ago it took me eight days to make the same journey. I am not in the habit of stopping long on these expeditions, and I went, I think, almost as fast as I could: only my means of conveyance in those days were, first of all, a steamer, then a troika, and then a tarantassa. Mr. Cust has taken 1864 as the starting-point for the Russian advance to the eastward, and he says: "In 1849 we thought little of Russia, though Soltikoff was moving about in our midst." It may be interesting, however, to recall what Russia was doing even before 1849: and I find in a pamphlet of my own, in which I quoted Russian authority, that: "In 1822, a series of regulations were promulgated for the government of the Kirgiz, who wandered in the Irtysh Ishim Steppe, and from 1834 they are under the jurisdiction of local courts. In 1834 the Alexandrovski fortification was erected near Kaidak, a bay of the Caspian. In 1846 the fortresses of Orenburg and Uralsk were founded in the heart of the Steppe, on the Rivers Irgiz and Tuegai respectively. In 1847 Fort Rainsk was erected near the mouth of the Sir Daria." After that, progress was very rapid indeed, and before 1864 we learn that Russian troops took possession of the Trans-Iti region, built Forts Vernoe and Kastik, north of the Issik Lake and Ala Tau Mountains, destroyed the Khokand forts of Pishpek and Tokmak, and later captured that of Yani Kurgan, and carried on several important local military surveys, with a view, if necessary, to further operations." As these data are taken from Russian writers, I think there can be little doubt about their accuracy. I remember, moreover, that when I first went out to India (now forty-five years ago) there was very much talk about Russian encroachment eastward, not quite so much as in after years, but enough to make it a subject of acknowledged interest in the country. It is true I was then in the Madras Presidency, and Madras has unfortunately the name of "benighted," so that possibly we were behind the rest of the world. With regard to Herat, I think that what Mr. Cust said is perfectly true, and, for my own part, I agree thoroughly with him. Possession of Herat is not necessarily possession of India, nor does it imply even possession of the key to India; but, as the lecturer further stated, it is all-important to us that Herat should not be possessed by Russia. We have invariably asserted its quasi-independence in respect of any country but Afghanistan; we have over and over again prevented the Persians taking it; we have actually waged war on its account with Persia; and if we allowed the Russians to possess the place, it would be said that we prevented the Persians but could not prevent the Russians. In that respect, our position would really suffer. At the same time, I admit that the necessity of our present care for Herat is rather a consequence of our past policy and acts than a necessity *per se*. Such is my humble opinion, although I know there are a great many high authorities who think differently. Mr. Cust refers truly to the steadiness of the Russian advance. Really the difference between Russia and England in a matter of the kind is, that Russia acts upon a fixed policy, whereas we act upon the policy of the Government of the day. I have no intention of talking politics, or comparing the acts of one Government with those of another, when I suggest this comparison as an explanation of the whole thing. If we had—and I should be very glad to think we were going to have—if we had a fixed Oriental policy, or rather a permanent Oriental Secretary of State, in the same way that we have a Governor-General of India not changeable with the Government of the day, we should, I think, be able to inaugurate a system of steady progress in principle like that of Russia, but without Russia's aggressiveness in practice. One great advantage of such a change would be that, on the occurrence of a crisis, we should

not have to be asking here and there for enlightenment on the cause and remedy : the information would be always at hand, and the action would be dictated by the recognized policy. I will make no further remarks upon this question beyond allusion to the railway scheme referred to by the lecturer and one or two gentlemen who have joined in the discussion to-day. Having been more than once along the sea-coast of that very desolate province which divides India from Persia, I should certainly say that a railway in Mekran would be not only feasible but easily constructed ; consequently that we have it in our power to connect India with Europe by a line very far removed from that contemplated by Russia towards Afghanistan.¹ Having reached Bander-Abbas through Mekran, there would not be very great difficulty in striking up into the interior to Ispahan through Kirman, following on westward to Bagdad, and there reaching a line of railway which must eventually, in the course of events, be constructed from Constantinople. By this means we get into no complications with Russia whatever. I trust that you will now allow me to return Mr. Cust our thanks for a very interesting lecture.

¹ Already our telegraph does extend for some hundreds of miles along this coast, under treaty with the Chiefs.



Friday, March 28, 1884.

MAJOR-GENERAL SIR LEWIS PELLY, K.C.B., K.C.S.I.,
in the Chair.

ON THE NECESSITY OF AN IMPROVED MEANS OF
COMMUNICATION WITH INDIA BY THE EUPHRATES
VALLEY ROUTE.

By J. B. FELL, Esq., C.E., Associate Inst. C.E.

THE CHAIRMAN : In introducing Mr. Fell to you this afternoon, I may state that he has enjoyed exceptional opportunities for acquainting himself with many important commercial and other details concerning this very interesting subject. I need not remind you that the question of communication with the Valley of the Tigris and the Euphrates has from the remotest historic times occupied, more or less prominently, the attention of the successive Governments and commercial committees of the Old World. In fact, a railway from the Mediterranean to the head of the Persian Gulf is but a modern term for the main connecting land link between the East and West. That main link happens to be coincident with a portion of the shortest line between England and India, and I think that no one who, away from the mere party contests of the hour, concerns himself with the permanent commercial, military, and political interests of our widely scattered Empire, can ignore events even now happening, which may give to France on the one side and to Russia on the other, to the eastward of the Mediterranean and Black Seas, a naval, strategical, and political position which may compel us, for the protection of British interests, to secure a central, a safe, and a remunerative line along which we may co-operate with other States for the development of commerce and civilization, or in the lamentable event of war along which we may operate with advantage.

THE subject of the Euphrates Valley Railway and our other routes of communication with India has been so often brought before the notice of this Institution, and of the British public during the last fifty years, that it might appear to have been already exhausted. Great events, however, which have recently occurred, have so far changed the conditions of this important question, that the subject of the Euphrates Valley route to India has passed far beyond its previous limits, and from being looked upon only as a very desirable object it has become one of absolute and urgent necessity, and consequently it presents itself again to this country under an aspect requiring a further and most serious consideration.

The principal events that have brought about these great changes are—

- 1st. The recent occupation of Merv by Russia;
- 2nd. The insufficiency of the Suez Canal and Egyptian route to India; and,
- 3rd. Their insecurity.

There will be many gentlemen present at this meeting who are much more competent to speak on these important matters than myself, and no one can speak on the Euphrates Valley Railway scheme with so much knowledge or authority as Sir William P. Andrew, who has for nearly thirty years been its patron and most energetic supporter.

Circumstances did not permit Sir William to give one of his admirable lectures here to-day, and as the Council of this Institution have been pleased to do me the honour of inviting me to read this paper, I have ventured to avail myself of the opportunity of doing so, having long taken a great interest in the Euphrates Valley route, and, residing in Lancashire, which is more concerned in it than perhaps any other part of England, I have been able to collect together information that may be of use in furthering the efforts that will certainly now be made for carrying out the undertaking of the Euphrates Valley Railway.

The subject under consideration mainly consists of two parts—the first being political and military, and the second being of a commercial, financial, and engineering character.

The facts to which I propose to call the attention of the meeting relate chiefly to the second part of the subject; but there are also some political and military facts on which I purpose to make a few observations in order that the discussion which will follow may place them in their true light and significance before the country.

The recent annexation of Merv by Russia has placed it within the reach of that great military and aggressive Power seriously to disturb, or even to threaten, the very existence of the British power in India, and notwithstanding what Russian Emperors and statesmen may say to the contrary, there can be no doubt that there is a large and influential body in the ruling classes of that country who adopt the traditions of Peter the Great and Catherine II, and confidently look forward to the acquisition, at no very distant period, of Constantinople and of India.

The policy and the practice of this party in Russia is to seize upon every opportunity, chance, and pretext by which these cherished objects can be advanced.

Such an opportunity was afforded for the last Russian move towards India by a combination of political circumstances favourable to her in the opinion of Russia, and by the attention of this country being occupied with our work and troubles in Egypt.

Some persons are incredulous as to there being the remotest danger of an invasion of India by Russia, and will not believe that such an invasion, if attempted, could be successful.

These persons should, however, remember that there are on record at various periods seven different invasions of India, all of which

have passed through Turkestan and Afghanistan, and all of which have been successful.

They should also remember that the aggressiveness of Russia is such that her acquisitions from Turkey and Poland are equal in extent to the whole of Austria and Germany.

That she has annexed the larger half of Sweden, and also a portion of Tartary equal to one-third of the area of Europe.

Bearing these facts in mind, and also the traditions referring to Constantinople and India, which have been handed down from generation to generation from the time of Peter the Great, it is impossible to believe that Russia could resist the temptation to seize upon our possessions in India if once she had it within her power to do so.

She would, of course, first have to establish herself in her newly acquired territory; to carry on in India her usual system of intrigue; to construct her projected railway from Krasnovodsk, or some other point on the Caspian Sea, to Merv, and to seize Herat should a fitting opportunity occur. She would then probably wait until England was engaged in some future war, when she would come down upon us with all the force of her vast military power, and if we are not better prepared than we are now she might succeed in driving us out of India.

By what means we are to be prepared to meet such an emergency, should it arise, it is for military men to say, but no doubt one part of their preparatory scheme of defence would be to recommend the construction of the Euphrates Valley Railway, in order to provide for the more certain and more rapid transport of troops and military stores to India; and this ought to be done while Russia is making her railway from the Caspian Sea to Herat or to Merv.

During the last ten years Russia has advanced her frontier several hundred miles forward in the direction of India, and to counteract the advantage she has thus gained over us, notwithstanding all her professions and promises to the contrary, we shall, for the better security of British interests, be obliged also to shorten the distance between England and India, and this, fortunately for us, can be done to the extent of a saving of six days in the time occupied on the journey between London and Bombay, by the construction of the Euphrates Valley Railway.

It will be seen that I have assumed that there can be no doubt that it is the fixed determination of the people of this country to maintain our rule in India as against Russia, and as against all comers.

Whether, at the present time, we have the power to give effect to this determination is a question for our military authorities to decide. With an Empire, the population of which is more than double that of the Russian Empire, possessed of more than double the wealth, and with soldiers second to none in the world, what can we have to fear from Russia?

We are told, however, that with all our resources at the present time we are not prepared for a war in India with Russia. Our troops are the best in the world, but the Emperor of Russia can say, as the Emperor Napoleon is said to have done, "Thank Heaven there

are so few of them!" Such being the case, the sooner the country is awakened to a sense of its duty, the more certainly, and the more easily, will the dangers and evils with which our Indian Empire are now threatened be averted.

That an alternative route to India has become a necessity from a political and strategical point of view will also be seen if we consider our present position in Egypt, through which country our only available route to India passes by the Suez Canal and the Alexandria, Cairo, and Suez Railway.

The former carries our enormous goods traffic of from 4,000,000 to 5,000,000 of tons per annum, and in war-time we are told that it could not be defended!

Lord Wolseley, speaking at a meeting of this Institution in 1878, gave it as his opinion that the Suez Canal might be quickly and easily destroyed, and remarked that, "as a nation it would be perfectly ridiculous for us to depend on the Suez Canal as a line of communication with our Eastern possessions in time of war." A singular illustration of this opinion was given in yesterday's evening papers, in which it is reported from New York that O'Donovan Rossa voluntarily gave to a newspaper correspondent the following, what he calls, interesting piece of news: "In less than four weeks," said the Apostle of Dynamite, who assured his visitor that he was not bragging, "*the Suez Canal would be no more!*"

"The way to hurt England was to ruin her commerce, and that was why attention was to be turned to the Suez Canal," which is to be "blown up with dynamite higher than a kite."

I mention this circumstance only to show that in war-time this means of attacking us certainly will not be overlooked.

If, in consequence of a war between England and any other European Power, the Suez Canal should be closed, and our Indian traffic be compelled to return to the old long sea route, the loss to this country caused by such an interruption of the traffic would be enormous, and it must be remembered that such a war might be brought about by an accidental conflict between British interests and the interests of some other European Power in Egypt, which conflict might be avoided if we were in possession of an alternative route to India, as also might be avoided all the frightful consequences of a war that probably would entail on this country a sacrifice of 100,000,000*l.* sterling, or even more.

The second part of this subject, while it is in one sense of a more practical character than the first, is not of less importance, since, great as the strategical value of the Euphrates Valley Railway would be, the country might not be willing for that object alone to sanction the expenditure of the large amount of capital necessary for its construction. If, however, it can be shown that the railway, when made, would pay interest, or something more than the ordinary rate of interest on its cost, then there might not be much difficulty in providing the capital required, either with or without a Government guarantee.

The engineering questions involved in the enterprise form also an essential part of the whole subject.

I do not propose to take up the time of the meeting by giving anything like a description of the Euphrates Valley Railway, which has so often and so ably been described here and elsewhere, but will speak only of its principal conditions, capabilities, and advantages.

The Euphrates Valley Railway is here intended to mean a railway from the Mediterranean to the Persian Gulf, following altogether the valley of the Euphrates, or partly by the valley of the Tigris.

The Mediterranean terminus of the line might be at Tripoli, or Seleucia, or Alexandretta, or at a point that has been proposed north of that town in the Bay of Scanderoon. The terminus on the Persian Gulf might be at Bussorah, or at Grain (El Kewit).

These are questions of secondary importance that will have to be settled when the time arrives for considering them; but what we have now to deal with is the main question, which is, Are we, or are we not, to have a railway from the Mediterranean Sea to the Persian Gulf as an alternative route to India?

I propose to offer a few remarks on some of the different ports and routes of the line, and, in order to avoid the inconvenience of speaking of a railway which has no defined locality, I will assume one route as a representative line of the whole scheme, with the understanding that it may be changed wholly or in part to any other of the projected lines that may ultimately be considered to be the most advantageous.

The particular line I have chosen for this purpose is the one commencing at the port of Alexandretta, crossing the Bailan Pass to Aleppo, and reaching the course of the Euphrates river at Balus. This is the line recommended by Mr. Telford Macneill as costing, including the harbour works, 500,000*l.* less than the line from the port of Seleucia by Antioch to Aleppo, while it would provide much more extensive harbour accommodation. The terminus on the Persian Gulf I have assumed to be at Bussorah, that being a convenient point from which to commence the prolongation of the railway to Kurrachi.

The length of the railway would be 850 miles, and the cost, as estimated by Sir John Macneill, for a light line on the mètre gauge would be 6,000,000*l.* sterling. If made on the 4 ft. 8½ in. gauge, with a permanent way equal to that of the main lines of Europe, the cost would be 8,500,000*l.* If made on the full Indian gauge of 5 ft. 6 in., the cost would be 9,000,000*l.*, and this latter gauge would appear to be the most suitable and economical.

Taking the summit level of the Bailan Pass to be 2,270 feet, and assuming that the counter gradients on the line would collectively give an additional similar elevation, the average gradient of the line would be about 1 to 500. From Alexandretta to Aleppo, for a distance of 90 miles, there would be curves of from 10 to 15 chains radius; for the remaining 760 miles there would probably be no curves of a less radius than 20 chains, and from the description given of the general character of the country, the development of the curves would be inconsiderable, so that the course of the railway would be practically almost a straight line. With gradients and curves so favourable as those above mentioned, a permanent way laid with 75 lb.

steel rails, and a gauge of 5 ft. 6 in., high speeds by the passenger and mail trains could be maintained, and low rates of carriage by the goods trains.

The carrying capacity of a single line of railway would be equal to 3,000,000 passengers and tons of goods per annum, and a double line would, in case of need, be able to carry the whole of the traffic now passing through the Suez Canal.

In the transport of the mails, passengers, troops, and the more valuable kinds of merchandize the Euphrates Valley Railway would effect a saving of six days in the journey between London and Bombay, and being, though only to a limited extent, a competing route, it would help to keep in check the high charges and arbitrary regulations on the Suez Canal, which have recently been the cause of so many complaints from British shipowners using the canal.

Captain E. Rice, R.N., in his report to the Admiralty, published in September last, states that "the average time occupied by British ships in passing through the Suez Canal is seventy hours" for a distance of 100 miles, and it is a striking fact in illustration of the value of the Euphrates Valley route that by it the whole distance of 850 miles from the Mediterranean to the Persian Gulf could be performed in 24 hours, or less than half the time occupied in the passage of 100 miles of our present only available route to India!

The respective charges for the use of the canal and the railway are equally disproportionate, the charges incident on the cargo for the use of the canal being 10s. per ton for the distance of 100 miles, and, assuming a total traffic of but one-sixth of that now passing by the Egyptian route, they would only be the same for the toll charged for the use of the 850 miles on the Euphrates Valley Railway, the charges for power, ships, and wagons being, of course, excluded in both cases.

There is no doubt that the steam-power employed to propel a ship is less expensive than the power of a locomotive engine, but important improvements can be made in the latter by which it may be adapted as regards both speed and economy, for such a special service as that of the Euphrates Valley Railway.

A correspondent writing to the "Engineer" paper, last December, on the Suez Canal question, observes: "There is one point to which I do not think any reference has been made, and that is the part the compound marine engine has played in the success which has attended the canal. It is really to the state of perfection to which this engine has been brought within the last fourteen or fifteen years that the success the canal has attained is mainly due. Only for this invention it would have been impossible for any but heavily subsidized mail-steamers to have made use of the Suez Canal between England and India, in which case it would have proved as great a failure financially as, fortunately for M. de Lesseps, it happens to be a success."

When the time comes for running locomotives from the Mediterranean to the Persian Gulf, English engineers and engine-builders will prove themselves to be quite as competent to build improved locomotive engines that will be as perfectly well adapted for the work

they have to do as the compound marine engines that are said to have contributed so much to the success of the Suez Canal.

With such locomotives the highest speeds will be attained by the express trains and the lowest cost of traction by the goods trains.

The distance from Alexandretta to Bussorah will be regularly performed in twenty-four hours, or in eighteen hours should such a speed at any time be necessary. With a low rate of toll for the use of the railway, and a low cost of traction, taking also into account the expense of loading and discharging at the two seaports, and considering the advantage of the saving in time, there can be no doubt that the Euphrates Valley Railway would carry a considerable portion of the higher class of goods now sent by the Suez Canal route. Our trade with India would benefit by this accelerated means of transport, and any loss of traffic sustained thereby by the Suez Canal would be more than compensated by the increase of the trade that would result from the opening of the Euphrates Valley route.

In speaking of the cost of working the railway I have kept in view the summit level of the Bailan Pass, over which the traffic would have to be carried. If the port of Antioch should be considered to be the best point of departure on the Mediterranean the elevation would be less by about 1,500 ft.; but besides the great additional cost of a line following the valley of the Orontes, the sacrifice might be still greater from a strategical point of view, seeing that in the Mediterranean port it would be necessary to have ample accommodation, not only for the mail and merchant steamers engaged in the Indian traffic, but also for transport ships and for the Mediterranean fleet. Without this accommodation the railway would not be all that would be required for State purposes. Some persons seem to have an exaggerated idea of the difficulty of surmounting this Bailan Pass, which is not at all formidable when compared with other railways. The line over which the Indian mail regularly travels between Calais and Brindisi rises to an elevation of 4,390 ft., or nearly double the height of the Bailan Pass. The Central Pacific Railway rises to a height of 7,021 ft. above the level of the sea. The Union Pacific rises 8,573 ft., and the Andes Railway 15,646 ft.

There is, therefore, nothing at all in a summit level of 2,270 ft. to weigh against the immense advantage of having the port of the Euphrates Valley Railway in a deep and spacious harbour, such as the Bay of Scanderoon, which is capable, we are told, of accommodating at one time the whole of the British fleet, and the time may come when such a port will be found to be invaluable. Who knows how many troops we may at a short notice have to despatch to India from Cyprus, or what still larger number of Indian troops may be brought over to that island when it has become, what Lord Beaconsfield in his far-seeing policy designed it for, a strong place of arms, and in the event of our being engaged in a conflict with Russia in Europe?

An objection has been made to Alexandretta as a terminus of the railway on account of its unhealthiness from the bad drainage of the town; but Mr. Telford Macneill, in his evidence before the Select

Committee of the House of Commons, stated that this objection could be removed by an expenditure of 3,000*l.* on drainage works, and even if these works should cost 20,000*l.* or 30,000*l.* and the town could thereby be made perfectly healthy, it would be infinitely better to spend that money than to give up the great advantages of the harbour and bay of Scanderoon.

With regard to the alternative routes proposed by the Euphrates and Tigris Valleys, the selection of one route need not, perhaps, necessarily exclude the other, for if the traffic should be developed as rapidly as on the Suez Canal, a double line of railway would soon be required, and in place of making a double line for the entire length it might be better for the purposes of the local traffic, which it is believed will be a large one, to make two single lines for such a portion of the distance as it might be considered desirable in order to provide for the local traffic of both valleys. It should be observed that the Euphrates Valley route has this advantage over the Suez Canal, and it is a very important one, that while the former will have a large and profitable local traffic the latter has absolutely none, and if from any cause whatever the through traffic should fail, the canal would become valueless, which would not be the case with the railway, as the local traffic alone would always pay a fair rate of interest.

One of the most vital questions of the Euphrates Valley Railway scheme is, "To what extent, and by what means, the railway, when made, could be defended?" Civilians are, of course, unable to form any correct opinion on this purely military question, and members of the Royal United Service Institution would render a most important and acceptable service to the country if, in addition to an expression of their views on the strategical value of the Euphrates Valley route to India (especially in relation to recent events in Egypt and at Merv), they would also point out in the discussion in what locality, to what extent, and from what Power the railway would be exposed to the danger of a hostile attack. It appears to be generally understood that the only or the chief danger is from Russia, and if it be so, what would be the nature and extent of Russia's offensive power against us? What would be our means of resistance, and, taking into account all the conditions of such a conflict, would the superior advantage be with Russia as the attacking, or with England as the defending Power?

Although the railway does not lie within the part of Asiatic Turkey over which England has acquired the protectorate, still the Euphrates route is under the shelter of that protected country, which is much the same thing.

In the event of an attack from Russia, I assume we should have a decided advantage over her in the important matter of transport. Kars is the nearest point to the Euphrates route, but it is at a distance of over 400 miles, and should an expeditionary force of, say, 50,000 men be sent to occupy the Euphrates Valley, such an army probably would not march that distance in less than three weeks, while we could, by sea and rail in the two directions, move the same number of men to the same place in less than half the time. Would not also a

Russian army, fighting at so great a distance from its base of operations, be in danger of having its communications cut off by an attack on its rear from Trebizond, or some other port in the Black Sea?

Whatever may be the danger to which the Euphrates Valley route to India might be exposed, would not the risk of an interruption of the traffic in war-time be less on that than upon the Suez Canal route, where we have under our protection at the present time a line of country, from Port Said to Suakin, equal in length to the distance from the Mediterranean to the Persian Gulf? Besides, the great length of the line we should have to defend in the Euphrates Valley would, according to the opinion of the Russian General Skobelev, far from being a disadvantage, be one of our greatest advantages as regards Russia, since it would form part of our great military base of operations, reaching from Cyprus to the Persian Gulf, Kurrachi, and Candahar; the whole line being furnished with steam. Absolute security there probably could not be in either case, but military men may be able to form an opinion as to which of the two routes is the least exposed to danger, and, as the danger would arise in each case from different causes, an alternative route would possess the immense advantage that in the event of one of the two routes being closed the other would be open, and either of them would be sufficient to carry the whole of our traffic from and to India.

We now come to a part of the subject that civilians can better comprehend, as it is not a question of war, but of what are commonly called "the sinews of war," without which but few things that are both great and good can be accomplished.

Sir William P. Andrew has devoted so many years of labour, with all the advantages of his great Indian experience, to acquiring the information necessary for forming a reliable scheme for the carrying out of the Euphrates Valley Railway, that it has become a comparatively easy task to show, from an engineering point of view, that the construction of the railway is practicable—that commercially the undertaking would be profitable—and that financially it ought to be possible to find the necessary capital. I need not repeat what Sir William has so often said and written on this subject, but will only remind you of the conclusions at which he has arrived.

The statements I have made as to the engineering conditions and cost of the railway are chiefly based on the surveys, estimates, and reports made under Sir William's instructions by General Chesney and Sir John Macniell.

The existing traffic in the country, and probable traffic of the railway, have been taken by Sir William from Consular and other reliable reports, and his estimate of the net revenue of the railway based upon these would give a dividend of 5 per cent. upon the 9,000,000*l.* sterling I have stated would be required to make the railway, on the full Indian gauge, the local traffic by itself being sufficient to pay a dividend of 3 per cent.

From information given to me in Lancashire, and from the traffic returns of the Suez Canal, I think the estimate of the through traffic may be safely and considerably increased, that there is every prospect

of the Euphrates Valley Railway paying a larger dividend than 5 per cent., and of being in every sense a most successful enterprise.

Estimates, however, are not guarantees, and although a guarantee of a minimum rate of interest might cost this country nothing, it would enable a company constructing the railway to obtain the capital on more favourable terms, and the Government would in return obtain strategical advantages of immense importance and value.

The Government have not hitherto been willing to give this guarantee, but the Russian occupation of Merv, and our troubles in Egypt, may now induce them to reconsider this most important matter.

They have invested 4,000,000*l.* of British capital in the Suez Canal, and were ready to invest 8,000,000*l.* more, but they say the success of that undertaking was already proved—and so is the success of the Euphrates Valley Railway for State purposes—there cannot be a shadow of a doubt about this, and, commercially, it has as fair a prospect of success (if the concession can be obtained, and the line when made can be defended) as the Suez Canal or any railway that has been made with a State guarantee in India.

The Government are said to have asked from the Porte a concession for the scheme for the Jordan Valley Canal, which commercially, and from an engineering point of view, is, however, impracticable. One estimate of its cost is 222,700,000*l.*, whilst the lowest appears to be 65,000,000*l.* If made, it would simply be a duplicate of the Suez Canal, and not a substitute for the Euphrates Valley Railway. And further, the danger to India from Russian aggression will have come and gone long before such a canal could have been constructed.

The question for the Government now to consider appears to be, would the Euphrates Valley Railway, as an alternative and shorter route to India, be worth for State purposes a guarantee of 4 per cent. on a capital sum of 9,000,000*l.* sterling? The limit of the risk would be 360,000*l.* per annum, less the net earnings of the railway, which there are well founded reasons to believe would amount to at least 473,000*l.* per annum.

The German, Italian, and Swiss Governments gave not guarantees only, but large subventions—*à fonds perdus*—to secure the making of the St. Gothard Trans-Alpine Railway, on which there is an annual loss of 360,990*l.* sterling.

Are our Anglo-Indian interests of less value and consequence than those of the three countries separated by the Alps? Or is our Government less enlightened and less patriotic?

One answer only can be given to the former question: the trade and relations of the two countries north of the Alps with Italy can bear no comparison with the magnitude of our interests in India; and as regards the latter, if our Government decline to do what the Governments of other countries would do under similar circumstances, then there are three alternative courses for the people of this country.

1st. To do without the Euphrates Valley Railway, and run all risks as regards our communications with India for the future.

2nd. To provide the capital and make the railway for English interests, but without a guarantee; or

3rd. To form an international company, like the Suez Canal Company, the capital being subscribed partly in England, and partly abroad.

I cannot help thinking that the first-mentioned solution of the Euphrates Valley Railway question would be most disastrous for this country.

If the second can be carried out, the limit of the loss to the country would be the amount of the premium the Government would have to pay as an indemnity, or legitimate profit, to the capitalists who had embarked in the enterprise without a State guarantee. This might, however, be a very considerable sum, as they might not be able to make the same good bargain with English capitalists as Lord Beaconsfield did with the Khedive.

The third alternative would be less favourable for this country, for if foreign capitalists were proprietors to a great extent of the undertaking, the English Government might not be able to get possession of it upon any terms, and, in the possible event of the Euphrates Valley Railway passing into the hand of any foreign Power, it might have been better for this country that the railway had never been made.

From the published expressions of their opinions it would appear that Russian statesmen and Russian Generals understand the true value to us of the Euphrates Valley route better than we do ourselves, and in France this momentous question is perfectly well understood.

Each year as it passes brings with it fresh and irresistible evidence that the Euphrates Valley Railway is an Imperial and an absolutely imperative necessity.

The magnitude of the interests involved in it has become so great that it can no longer be neglected or held in abeyance without incurring the danger of consequences that would shake to their very foundations all the great Powers of Asia and Europe.

The shadow of the great Russian Colossus has now fallen across that line within which Russian influence can never, without imminent danger to our possessions in India, be tolerated. If we intend, as we are in duty bound, to hand down to future generations this one of the brightest jewels in the Imperial Crown of England which we have inherited from generations who have passed away, we must at once prepare to face the grave responsibilities that may await us in the immediate future. And no scheme for the defence of India could be complete or successful that did not provide for the construction within the shortest possible period of the Euphrates Valley Railway.

The CHAIRMAN : As the paper read before us is rather of an extensive character, and as our immediate object, as I understand it, is to inquire into the present advisability or otherwise, in its commercial, military, and miscellaneous aspects, of a line connecting the Mediterranean Sea with the head of the Persian Gulf, we should, I think, exclude as much as possible from our discussion that other portion of the subject which relates to a possible line from the head of the Persian Gulf to the frontiers of India. I know from personal inspection that a line of rail along

of the Euphrates Valley Railway paying a larger dividend than 5 per cent., and of being in every sense a most successful enterprise.

Estimates, however, are not guarantees, and although a guarantee of a minimum rate of interest might cost this country nothing, it would enable a company constructing the railway to obtain the capital on more favourable terms, and the Government would in return obtain strategical advantages of immense importance and value.

The Government have not hitherto been willing to give this guarantee, but the Russian occupation of Merv, and our troubles in Egypt, may now induce them to reconsider this most important matter.

They have invested 4,000,000*l.* of British capital in the Suez Canal, and were ready to invest 8,000,000*l.* more, but they say the success of that undertaking was already proved—and so is the success of the Euphrates Valley Railway for State purposes—there cannot be a shadow of a doubt about this, and, commercially, it has as fair a prospect of success (if the concession can be obtained, and the line when made can be defended) as the Suez Canal or any railway that has been made with a State guarantee in India.

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the coast of the Persian Gulf and of Mekran would be a difficult undertaking. It would traverse the watershed of a tract liable to sudden flood after a rainfall in the hills, and I fear when you have to take into consideration the indentations of the coast line, you would find that from Kurachi to Cape Mussendom, and so up to Bunder Abbas and by Bushire to Kowait, Bussorah, or even to Mohammara, you would have to contract for more like 1,500 than 1,000 miles. I think, therefore, we should restrict our inquiry and observations to-day to the line between the Mediterranean and the head of the Persian Gulf, and give, perhaps, particular attention to that aspect of it which deals with the left flank going eastward from the line of the Caucasus; and also to the present position of Russia at Merv, and probably at Herat.

Colonel BATEMAN-CHAMPAIN: You are aware, Sir, that I have some little claim to speak on this question. I have been engaged under Government in connection with the telegraphs in the Persian Gulf and elsewhere since 1862, and I may say I have travelled by twelve or fourteen different ways to and from India. Some years ago I twice rode home from Baghdad, once by the Tigris Valley to the Black Sea, and once by the Tigris Valley round to Alexandretta. I should not mention this except to show that I have had some means of forming an opinion on the question before us. I would begin my remarks by saying that although no one would be more glad than I to see local railways introduced in that wonderfully fine but unhappily governed country, Turkey in Asia, and to see these local lines gradually joined up as they were found to pay, so that in time possibly a through means of communication might be arrived at, yet I still entertain a very strong objection to a Government guarantee of any such line as has been spoken of to-day. I think any line that does not really pay will never be properly kept up, and that the Government guarantee would be misplaced. My reasons for this are as follows: I say that this line taken through the Euphrates Valley passes through an exceedingly poor country which would produce no local traffic whatever. When I say local traffic, of course I know Antioch and Aleppo are considerable cities, but below them on the Euphrates there is not a single place of any importance. The proposed route would pass near Baghdad, but would not touch any large city excepting Bussorah before arriving at Kurachi. Now if the Tigris Valley had been selected the line would pass through a far richer country by Aleppo, Diarbekr, Mosul, Baghdad, Bussorah, &c. What is the line to be made for? Who is going to use it? I will briefly refer to four heads, mails, goods, passengers, and troops, and then I will just touch on the military part of the question mentioned by the lecturer. As regards mails, they might possibly be sent by a Euphrates Valley Railway. I believe four days would be gained as compared with the Suez Canal line, but I doubt very much whether the difference would be so much as six. The promoters of this scheme are always, it seems to me, inclined to calculate on this projected railway working much faster than others do in practice. I have just been up from Kurachi to Lahore, and the speed on that line is under 17 miles an hour. I can tell you also that the last 26 miles run into Lahore is timed to take 1 hour and 39 minutes, and the train in which I travelled did it in 1 hour and 46 minutes. However, of course, it is possible to attain a better speed than that, and were the Euphrates route in operation, I admit that it might carry the mails. Secondly, as to goods, I believe none would pass. The rates of freight by the Suez Canal are exceedingly low, and one of the P. and O. ships by which I left last November took out to India 1,100 tons of coal from Brindisi as the most remunerative cargo she could obtain. I am convinced that you will find no goods that will pay for costly land transport to gain four or six days between England and India. Thirdly, as to the passenger traffic, you must recollect that railway travelling is exceedingly fatiguing and trying, especially to people who have lived for some time in India. Nine out of ten men, women, or children who return from India are more or less invalids, and to them the sea voyage is most beneficial. Very few of them would, in order to gain four or six days, travel over the dreary Euphrates Desert when they could come by sea in a comfortable ship. I arrived home last Saturday, and I may remark that the greater number of people on board preferred to brave the Bay of Biscay in March rather than go overland by Venice, and those who did come by Venice I think regretted it, though I must allow that my contention is somewhat

affected by the fact that we were subjected to three days' quarantine. I think, therefore, that passengers, as a rule, would prefer the longer sea route, and only a few would, in order to satisfy their curiosity, travel once, and once only, by the Euphrates Valley. Now as regards the fourth head, that is, the transport of troops. We Officers travel in India very comfortably first class; we get a large carriage to ourselves, and we can manage actually to go from Bombay to Calcutta without a halt! But in the hot season first class passengers usually do break the journey, and troops do so invariably. I think you would find it impossible to pack twelve or thirteen men in a third class carriage, and to send them from Alexandretta to Grain through the terrible heats that prevail during five or six months of the year (I might say more), on the greater part of that line. Lastly the military point, the vulnerability of the line. I would, for most reasons, prefer the Tigris line to the Euphrates, but the former presents one great disadvantage from a military point of view since it lies nearer Russia. You must remember that the Russians have a very large army in the Caucasus, and where you see Mount Ararat marked on the map is Russian dominion. The best part of the Russian army in the Caucasus consists of Cossacks, and if you adopt the Tigris route you will have your line of communication exposed to attack. I am only referring to this matter because it has been pointed out that our enemies will probably be, if any, Russians, and that Russia has an enormous army mainly composed of Cossacks in the Caucasus. But it is not a case as Mr. Fell assumed of sending a large army to destroy the railway. Mr. Fell has referred to O'Donovan Rossa's boast that he will blow up the Suez Canal, but how much more easy it would be for O'Donovan Rossa, or a party of half a dozen Cossacks, to blow up a single bridge on this railway. A few horsemen could interrupt communication anywhere they pleased without the smallest difficulty, and how are you to prevent them? The only single bit that we have to protect on the Suez line is the Suez Canal, and if the Suez Canal is destroyed it is a short journey across the isthmus by railway; if the railway is destroyed, it is a short march across from Alexandria to the Red Sea; but interrupt your Tigris or your Euphrates line, and how are you to get your troops across from Alexandretta to the Persian Gulf? I think, therefore, that if the British Government were to adopt this proposed line we should be assuming a responsibility which we could not bear. Besides, we have heard nothing said about Turkey all this time. Are we going to take the line and march our troops backwards and forwards, and conduct military operations in this country regardless of the Turk? That might prove a considerable difficulty. We have not, in fact, control of that country. If we had, the question would be quite different to what it is at present; I should be delighted, I repeat, to see these regions governed better than they are, and local lines judiciously planned would be in time most beneficial. I have, however, thought it well to explain to the meeting why I entertain the strongest objection to anything like Government support being given to a line which I believe would not be useful for any one of the four objects to which I have referred.

The CHAIRMAN: Then we are to understand you are in favour neither of the Baghdad line nor of the direct one?

Colonel CHAMPAIN: Not as a through communication.

Colonel PASKE: Having already, by speech and pen, joined in advocating the Euphrates Valley Scheme, I crave permission to take a brief part in the present discussion. The feasibility and utility of the projected railway has been demonstrated by several authorities. The march of events, political and commercial, tends to show that it is a necessity upon which action should be taken without delay. While we are halting, Russia is active. It is understood that Russia is already contemplating the extension of her Trans-Caucasian line to Resht, the seaport of Tehran, to be followed by an extension to that capital, and thence to be carried down the Persian Gulf ostensibly in the interests of the petroleum trade. What at first sight would appear to be the most comprehensive scheme would be a line from Alexandretta or other port on the Syrian coast through Aleppo to Bir up to Diarbekr, to be connected with any Turkish railway system; from Diarbekr to be taken downwards along either bank of the Tigris to Baghdad, from there to be connected with any future Persian railway system *via* Kirmanshah to Tehran. This route, however, would be the longest and most costly, and there is one

insuperable objection, that the line would be at all times exposed to destruction by the aggressive action of a Power which already possesses the strongholds of Armenia and commands the head of the Tigris. But, on the other hand, the least costly and safest route would be the line from Alexandretta through Aleppo to a point on the Euphrates; from thence down the right bank of that river to Grain or Keweyt in the Persian Gulf. This line could always be supplemented hereafter by a branch line to Diarbekr, to connect it with the Turkish system, and also a very short line to connect it with Baghdad. The first section of this line passes through a comparatively rich and populous country, and would connect the important town of Aleppo with the seaboard. The last section of the line would also pass through a comparatively populous country, and would enormously extend the already large traffic between Baghdad and the holy places of Kerbella and Nedjif. Active operations should be commenced upon both the extreme sections simultaneously, carried up from the termini to the river, where the temporary stations on the river could be connected by river steamers. The Scinde, Punjaub, and Delhi Railway and the projected Euphrates Valley Railway were both, I believe, the conceptions of Sir William Andrew's active mind; one has become an accomplished fact, the other halts in the stage of contemplation. But there are some features connected with both routes which point to the conclusion that if one has become a success, the other might also be a success. Both routes start from the sea-coast; the extreme sections of both routes pass through a comparatively rich and populous country; both the extreme sections could be worked independently; both sections run up to the river, the temporary stations on which will be connected by river steamers, and the main portions of both lines run parallel to a mighty river, through desert and somewhat inhospitable tracts. If the difficulties have been surmounted in one, they can be overcome in the other. Before closing I would remark that I was this morning with that able and talented Officer, Sir Frederic Goldsmid, who regrets very much his inability through indisposition to attend this afternoon, but a remark he made to me, I think, deserves repetition. Sir Frederic said, "Let us use the Suez Canal as much as we can; let us take every possible advantage of it; but it never can be our own. Let us make the Euphrates Valley Railway; it will be our own road to India."

The CHAIRMAN: Before asking Commander Cameron to join in this discussion, and in reference to what you said concerning Sir Frederic Goldsmid, I may just mention that the Secretary has placed in my hands a note from General Goldsmid expressing his great regret at being unable to attend this afternoon, and saying, "As regards my opinion of the line to be adopted, I have not in the least modified it since reading my paper on Cyprus in June, 1879."

Commander CAMERON: I have for some time paid considerable attention to the question of these routes. I have my own ideas as to the best route, but at present I do not think the question is simply one of route. It is a question of the necessity of another line to India going through the country under discussion. We have heard Colonel Champain say that we shall be attacked by the Russians. The Russians are advancing in two directions; they are advancing on India on the one hand, and they are advancing on Constantinople on the other. The object of the campaign, by the political development brought about by the Treaty of Berlin, was to a great extent frustrated, the route through the Turkish peninsula being no more open than before. The future advance will be most probably through Armenia, which they are trying in every way to bring under their power, and Anatolia. Why should we be afraid of the Russians being on our flank? General Skobelev was much more afraid of our being on their flank. I think Mosul is one very important point, for, I believe, that ancient history teaches us the best places for the different routes. Mosul is the ancient Nineveh, and Mosul at the present day is a most important strategical and commercial point. Napoleon said that the country in the Valley of the Tigris was the strategical key of the whole world. The Russians see the value of Mosul. Since Major Clayton read his paper here on the Russo-Turkish frontier in Asia Minor they have appointed a Consul at Mosul, and they are sending Russian agents into Kurdistan to find out the routes by which they can come down towards Mosul so as to attack us. They regard England as a barrier between them and Constantinople, and they also envy us the possession of India.

We have, therefore, in considering these routes to look upon them in two ways, as means of offence and defence. Taking whatever line we bring across there we have our Indian troops on the one side and our home army on the other. And when Cyprus becomes what it should be, and what I hope it will be one day, a fortified *place d'armes*, and that we shall see a Mediterranean division of marines there, which would give a marine General a chance of commanding his own men in a proper position, from Cyprus we shall be able to launch our men towards Aleppo and Diarbekr, and by the Persian Gulf to Dilam, and thence by rail to Baghdad and Mosul. There the men from England and the men from India will shake hands together, and the Russians, disorganized by their march through the mountains of Kurdistan, will be met by Englishmen fresh and fit, having been transported by rail. I think the local traffic is ample, according to the present trade, to pay for the line which I wish particularly to have. If it had not been for the unfortunate death of Mr. Cazalet at Constantinople, instead of having, as we have been so many years, talking about this railway, we should have made a commencement before now. I have a strong opinion that Tripoli is the proper place from whence the railway should start. Alexandretta has not a harbour; there is no shelter within five and twenty miles; whereas at Tripoli ships can lie in safety. There is an easy path into the interior, and then this line between Aleppo and Damascus would intercept all the traffic coming eastward into the Mediterranean. It would intercept all the old routes, the Aleppo and Palmyra routes, and all the trade of the Haran, where the grain is wasted every year, would come down to Tripoli. Tripoli is only six hours' steam from Famagusta, in Cyprus. Our ships might be lying in Famagusta harbour one night, and the next morning they might be at Tripoli, and on the end of the line. There are other lines to the east, such as the great one by Constantinople, which no doubt will come. I do not care which line begins, but I am certain it is a political necessity that we should have one or more of these lines, and I am sorry to hear Englishmen saying that they are afraid to make a line that will be an advantage to England. If England is afraid of anybody, then England's decay has begun; but any one of these lines once commenced will lead to the others, and I hope and trust before any of us are much older we shall see the domain of discussion quitted, and that of work entered on.

MR. R. CUST: I am sorry to see this great subject treated purely from an English point of view. It is a great world-question. If we were in Paris and heard a number of Frenchmen saying, "We must have this railway because of 'la France,'" we should laugh at them and say, "Who are you to make Asia simply a chess-board for France and for her Colonies?" The same thing applies to us. We must be actuated by a higher motive, and think of the welfare of these great countries—and the progress of the whole world. I am sorry that Mr. Fell has based his paper upon antagonism and hostility to Russia. If Russia has extended her provinces for the last forty years, so have we. Look all over the world and see how much we have increased our possessions during the last forty years. Russia has only been urged on by the same inevitable tendencies which has impelled England. This railway is no doubt a necessity for commerce and for the communication between nations, and it should be based upon international principles. Speakers have alluded only to Russia, but they have forgotten the names of France, Austria, and Italy, who will have something to say on this matter. It is a great Mediterranean question, and the Mediterranean Powers will be heard before they let "perfidious Albion" take possession of Mesopotamia, and have her railways there. The Suez Canal is an international question. We are always urging that it is to be an international canal for the benefit of all nations, and this railway, if it is started, must be upon a similar basis, and, if it is not, it will not answer. Our friend Mr. Fell has placed before us the brightest view of the subject, but he has not alluded to the climate of Mesopotamia. Why is that country so left out in the cold, or rather in the heat, and not occupied by a dense population? It is on account of the excessively bad climate. One speaker has mentioned the Euphrates Valley as being a perfect desert from Aleppo to Baghdad. There is no local traffic. Why is it so? On account of the detestable climate. Nature has placed that bar against civilization, population, and commerce. The impediment has to be fought against, and no doubt it will be triumphed over; but still it

insuperable objection, that the line would be at all times exposed to destruction by the aggressive action of a Power which already possesses the strongholds of Armenia and commands the head of the Tigris. But, on the other hand, the least costly and safest route would be the line from Alexandretta through Aleppo to a point on the Euphrates; from thence down the right bank of that river to Grain or Kewey in the Persian Gulf. This line could always be supplemented hereafter by a branch line to Diarbekr, to connect it with the Turkish system, and also a very short line to connect it with Baghdad. The first section of this line passes through a comparatively rich and populous country, and would connect the important town of Aleppo with the seaboard. The last section of the line would also pass through a comparatively populous country, and would enormously extend the already large traffic between Baghdad and the holy places of Kerbella and Nedjif. Active operations should be commenced upon both the extreme sections simultaneously, carried up from the termini to the river, where the temporary stations on the river could be connected by river steamers. The Scinde, Punjab, and Delhi Railway and the projected Euphrates Valley Railway were both, I believe, the conceptions of Sir William Andrew's active mind; one has become an accomplished fact, the other halts in the stage of contemplation. But there are some features connected with both routes which point to the conclusion that if one has become a success, the other might also be a success. Both routes start from the sea-coast; the extreme sections of both routes pass through a comparatively rich and populous country; both the extreme sections could be worked independently; both sections run up to the river, the temporary stations on which will be connected by river steamers, and the main portions of both lines run parallel to a mighty river, through desert and somewhat inhospitable tracts. If the difficulties have been surmounted in one, they can be overcome in the other. Before closing I would remark that I was this morning with that able and talented Officer, Sir Frederic Goldsmid, who regrets very much his inability through indisposition to attend this afternoon, but a remark he made to me, I think, deserves repetition. Sir Frederic said, "Let us use the Suez Canal as much as we can; let us take every possible advantage of it; but it never can be our own. Let us make the Euphrates Valley Railway; it will be our own road to India."

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Commander CAMERON: I have for some time paid considerable attention to the question of these routes. I have my own ideas as to the best route, but at present I do not think the question is simply one of route. It is a question of the necessity of another line to India going through the country under discussion. We have heard Colonel Champain say that we shall be attacked by the Russians. The Russians are advancing in two directions; they are advancing on India on the one hand, and they are advancing on Constantinople on the other. The object of the campaign, by the political development brought about by the Treaty of Berlin, was to a great extent frustrated, the route through the Turkish peninsula being no more open than before. The future advance will be most probably through Armenia, which they are trying in every way to bring under their power, and Anatolia. Why should we be afraid of the Russians being on our flank? General Skobeleff was much more afraid of our being on their flank. I think Mosul is one very important point, for, I believe, that ancient history teaches us the best places for the different routes. Mosul is the ancient Nineveh, and Mosul at the present day is a most important strategical and commercial point. Napoleon said that the country in the Valley of the Tigris was the strategical key of the whole world. The Russians see the value of Mosul. Since Major Clayton read his paper here on the Russo-Turkish frontier in Asia Minor they have appointed a Consul at Mosul, and they are sending Russian agents into Kurdistan to find out the routes by which they can come down towards Mosul so as to attack us. They regard England as a barrier between them and Constantinople, and they also envy us the possession of India.

We have, therefore, in considering these routes to look upon them in two ways, as means of offence and defence. Taking whatever line we bring across there we have our Indian troops on the one side and our home army on the other. And when Cyprus becomes what it should be, and what I hope it will be one day, a fortified *place d'armes*, and that we shall see a Mediterranean division of marines there, which would give a marine General a chance of commanding his own men in a proper position, from Cyprus we shall be able to launch our men towards Aleppo and Diarbekr, and by the Persian Gulf to Dilam, and thence by rail to Baghdad and Mosul. There the men from England and the men from India will shake hands together, and the Russians, disorganized by their march through the mountains of Kurdistan, will be met by Englishmen fresh and fit, having been transported by rail. I think the local traffic is ample, according to the present trade, to pay for the line which I wish particularly to have. If it had not been for the unfortunate death of Mr. Cazalet at Constantinople, instead of having, as we have been so many years, talking about this railway, we should have made a commencement before now. I have a strong opinion that Tripoli is the proper place from whence the railway should start. Alexandretta has not a harbour; there is no shelter within five and twenty miles; whereas at Tripoli ships can lie in safety. There is an easy path into the interior, and then this line between Aleppo and Damascus would intercept all the traffic coming eastward into the Mediterranean. It would intercept all the old routes, the Aleppo and Palmyra routes, and all the trade of the Haran, where the grain is wasted every year, would come down to Tripoli. Tripoli is only six hours' steam from Famagusta, in Cyprus. Our ships might be lying in Famagusta harbour one night, and the next morning they might be at Tripoli, and on the end of the line. There are other lines to the east, such as the great one by Constantinople, which no doubt will come. I do not care which line begins, but I am certain it is a political necessity that we should have one or more of these lines, and I am sorry to hear Englishmen saying that they are afraid to make a line that will be an advantage to England. If England is afraid of anybody, then England's decay has begun; but any one of these lines once commenced will lead to the others, and I hope and trust before any of us are much older we shall see the domain of discussion quitted, and that of work entered on.

MR. R. CUST: I am sorry to see this great subject treated purely from an English point of view. It is a great world-question. If we were in Paris and heard a number of Frenchmen saying, "We must have this railway because of 'la France,'" we should laugh at them and say, "Who are you to make Asia simply a chess-board for France and for her Colonies?" The same thing applies to us. We must be actuated by a higher motive, and think of the welfare of these great countries—and the progress of the whole world. I am sorry that Mr. Fell has based his paper upon antagonism and hostility to Russia. If Russia has extended her provinces for the last forty years, so have we. Look all over the world and see how much we have increased our possessions during the last forty years. Russia has only been urged on by the same inevitable tendencies which has impelled England. This railway is no doubt a necessity for commerce and for the communication between nations, and it should be based upon international principles. Speakers have alluded only to Russia, but they have forgotten the names of France, Austria, and Italy, who will have something to say on this matter. It is a great Mediterranean question, and the Mediterranean Powers will be heard before they let "perfidious Albion" take possession of Mesopotamia, and have her railways there. The Suez Canal is an international question. We are always urging that it is to be an international canal for the benefit of all nations, and this railway, if it is started, must be upon a similar basis, and, if it is not, it will not answer. Our friend Mr. Fell has placed before us the brightest view of the subject, but he has not alluded to the climate of Mesopotamia. Why is that country so left out in the cold, or rather in the heat, and not occupied by a dense population? It is on account of the excessively bad climate. One speaker has mentioned the Euphrates Valley as being a perfect desert from Aleppo to Baghdad. There is no local traffic. Why is it so? On account of the detestable climate. Nature has placed that bar against civilization, population, and commerce. The impediment has to be fought against, and no doubt it will be triumphed over; but still it

will be a question beyond the power of England alone to grapple with. It must be an international question carried out with the consent and goodwill and contributions of all the great nations who have interest in intercourse with the East. Do not suppose that England is the only country that has interests in the East. France would not allow that for one moment, nor would Italy, nor Austria. They are extremely jealous of us at the present moment; this Egyptian question has raised up a tremendous amount of suspicion and trouble, and now we are asked to go down to Mesopotamia and to create an interest there to be of a purely national character. If we made it international and commercial, we might then go to other nations and say, "Join with us on this basis;" but the lecturer distinctly says that it is an English question, for English interests, and for English commerce, and to strengthen our hold on India. Colonel Paske referred to Sir William Andrew's railways—he had two schemes: one the Scinde Valley and the Punjab, and the other in the Euphrates Valley; one has succeeded, and the other will, according to Colonel Paske, succeed, but they are totally differently circumstanced. The Punjab Railway is in India. It runs through British provinces, it has been constructed by British capital; but the Euphrates Valley Railway runs through Turkey, and do you think that Turkey would sit quietly by and let us appropriate a line of railway right through her territory? It is not in the least likely. And if Turkey were willing to do so, France and the other Powers would not give their consent. It is therefore a very great and serious question of international interest, which will not be settled in this kind of way,—by coming here, reading a paper, and drawing a plan upon a map. With regard to Constantinople, within a year hence a railway from Vienna to Constantinople will be in full order through Belgrade, Sophia, and Philippopolis, and in that way we shall find a part of our journey to India accomplished. The next step will be a line from Constantinople through Asia Minor and Mesopotamia, and to Bussorah or some other port upon the Persian Gulf; and if that be undertaken in the regular way as an international matter, it will be done; but if it is undertaken in the vaunting spirit of English influence, English Jingo, and English prestige, it will be only throwing away our money and will not succeed.

Captain BEDFORD PIM, R.N.: I cannot allow my very patriotic friend, Mr. Cust, to talk about the interests of other nations when we are discussing here solely the interests of England. We do not care twopence for any other nation in the world. We are here to discuss what is best to be done with regard to an alternative route to India, that route being by the Euphrates. I must confess I have listened with a great deal of pleasure to Mr. Fell's paper. Mr. Fell certainly does not take any of the views that Mr. Cust advocates; he goes in for English enterprise. We must always remember that English enterprise has made this country. We should have been nowhere without English enterprise; and in the autumn of our life to fall off and not do anything in this way seems to me to be throwing up the sponge at once. I was very glad to see the passage-at-arms between the gallant soldier, Colonel Champain, and my gallant friend Captain Cameron, of the Royal Navy. They went at one another very fairly indeed; but I am bound to say, knowing something about these countries, that the climate is not so bad as has been represented in this room. I should say that the climate was very nice indeed. I know I have been in many countries infinitely worse. I cannot see anything the matter with the climate; though, of course, if you are determined to make yourselves ill in those climates, it is very easy to do so. With regard to the Suez Canal, Mr. Fell says it is utterly inadequate to carry on the present traffic. I beg to join issue, and to say that, without turning a spadeful of sand out of that canal, you can make it adequate for all the commerce that for many years to come will pass through it in English bottoms. It may be done in this way. I have no doubt that Mr. Fell knows Mr. Robert Stephenson, and has heard of his hydraulic lift for placing ships upon pontoons drawing only 4 feet of water, and floating those ships in any direction you choose. By simply having a hydraulic lift at Said and Suez, you could pass through three times the capacity of tonnage that you could pass through at the present moment; and I think Mr. Fell, with his great engineering ingenuity, will bear me out in that remark. Nothing could be more simple than the process; but a sort of glamour is thrown over the present Government by

M. Lesseps, and until that is cleared away I suppose we shall not have any hydraulic lift down there to take more vessels through. With regard to the Euphrates Valley line, the real point, in my opinion, that should be used and utilized as the Mediterranean terminus is Ruad Island. That is a little to the north of Tripoli, and it might be made one of the finest harbours on the Mediterranean coast. It has the great advantage of being on the entrance of Kalnat El Medik, which you read of in Scripture. It takes you up into the interior of the country by a very easy grade, much easier than the mountain range of Seleucia. I was at the Royal Geographical Society on Monday last, and there heard a very admirable paper read by Colonel Sir Charles Wilson; and he gave it as his opinion, after being in that part of Seleucia for some time, and as that of the Officers who were with him, that it was utterly impracticable to run a line from Constantinople in that direction at all. So that, by way of Eskanderoon at all events, I think you may give up all hopes of a continuous line. The gallant lecturer regretted very much that he could not show us the sketches, which would show the heavy nature of the route, because those sketches were pigeon-holed at the War Office, and it was difficult to say whether they would ever come out again. My great admiration for the Euphrates Valley line is based upon a totally different reason from anything that has been mentioned in this room. I am very proud of my country, I love my country, and I think the great danger that we have to contend against is the failure of the food supply. Last year 1,000,000 tons of grain came from San Francisco and Cape Horn. Now, in the event of war, it would be impossible to bring that grain safely into this country. We have not got one solitary cruiser in the Navy fit to convoy that grain safely round Cape Horn. I will ask any naval Officer in the room to tell me of one vessel fit for this purpose. But here you have a route—the Euphrates—upon which the finest grain that the world has ever seen was formerly grown, and which, if you choose to send emigrants to, as we might do to any extent from Lancashire, would grow more than sufficient, not for England alone, but for all Europe. And then you have a route to bring that grain to the mother country by way of Cyprus, Malta, Gibraltar, perfectly safe. You do not want any cruiser to convoy that grain. You can bring that in under the shadow of those great fortresses; and if you can bring it in over that short distance without the expense of convoy, it follows that you bring it in cheaply. What we want is to have cheap bread in this country. We have been promised a cheap loaf for a long time, but my own experience is that it is now much dearer than it was when I was a boy. What we want now is to obtain a granary like the Euphrates Valley where we can grow sufficient grain to send to this country without risk of its being intercepted. I do not suppose there is an Officer in this room who does not understand sufficient of international law to know that any belligerent can declare food supply to be "contraband of war." If that is done, where should we be placed? We have something like 1,000,000 criminals in this country; we have 1,000,000 paupers; we have 600,000 habitual drunkards, and 100,000 lunatics. How are you going to support these people if your food supply is cut off? It is no laughing matter; hunger means revolution. I hope ladies and gentlemen when they go home will reflect upon it, and will remember that, while the little streak of sea was our greatest safeguard when I was young, it is now anything but that—it is a very serious danger to us, because we never have in this country more than six weeks' provisions, and to think what we should do if we lost the command of the sea is appalling—we should have to sue for peace on any terms that the enemy chose to make. With regard to Russia and the Euphrates Valley line, I believe in the fighting power of England, but I am bound to say, looking at it strategically, Russia would take us on the flank. The way the Russians are walking down through Tehran and on to the Persian Gulf is astounding. And that is where they would cut our line to India, and they would do it by having, not a *place d'armes*, but a harbour on the Gulf, absolutely impregnable, like Vladivostock at the present moment, they would take us then on both flanks and give us as much as we can do. I must apologize for taking up so much time, but I have taken a deep interest for many years in the questions raised by Mr. Fell this afternoon, and I have much pleasure in asking those present to accept the pamphlets with maps now on the table, and which treat of both "The Eastern Question" and "The Euphrates Valley Route."

Captain J. C. R. COLOMB : I did not intend to intrude myself on this discussion, but after what has fallen from Mr. Cust and from Captain Bedford Pim I would ask your indulgence to be allowed to make two or three observations. In the first place, I wish to remind Captain Pim that when he supports this railway project as a means to the end of growing food for this country, he is proposing to aggravate what I consider one of the greatest dangers of our position. His proposition is that we should grow our corn under a foreign flag. Our great danger at the present moment is that we are depending for our food on a foreign flag. He supposes that you will get the men of Lancashire, or any number of your surplus population, to go to a foreign country, and to a climate such as has been described by those who are best acquainted with it, when at this minute they don't go to our own splendid climates and fertile soils in Australia and Canada. The idea of growing food in that country through the means of emigration brought about by this railway is a notion which I think I am entitled to say I can in no sense agree with. We were told in the lecture that there were three courses open to us : one was to do without the railway ; the other was to give a national guarantee for its construction ; and the third, to leave it as an international concern, and that is the view taken by Mr. Cust. Now, Sir, I think we are out of our limit in discussing the commercial aspect of the question ; but I would caution military and naval men when they argue from the cosmopolitan commercial side. My friend here takes the cosmopolitan commercial side. I would point out that the fall of the Mediterranean Powers in the past was due to the divergence of the Eastern trade from that particular district which the railway would now, as it were, help to re-divert back to that quarter. And it is a curious fact that the result of the Suez Canal, which so re-directed the commerce of the world, has been, as a matter of international commerce, a greater benefit to Mediterranean ports and Powers than it has been to England. I say, therefore, that as a matter of cosmopolitan commerce, if you approach the railway from that point of view, I do not see that we have anything to do with it here. It is rather against than for our national commercial interest. With regard to a national guarantee, that could only be justified upon its being shown that this railway was of immense importance to our whole Empire as a matter of Imperial concern. The arguments that we have heard have been based upon the assumption that we have only to think of the United Kingdom and India. Another reason why I venture to speak is, that there is no comparison, in an Imperial point of view, between the value of the Suez Canal and that of any railway connecting the head of the Mediterranean with the Persian Gulf, for the reason that the railway proposed does not affect your China or your Australian trade. It does not affect the passage of the commerce of the one side of the world to the other, and that is most material. I think that we are piling up Imperial responsibility on the United Kingdom to a greater extent than we can bear. I think we do not do half enough as an Empire in defence of what we have got. Therefore this matter of railway communication, connecting these two seas, as it were, cannot be considered wholly and solely, as the lecturer is too apt to consider it, merely from an Anglo-Indian point of view. You cannot abandon the Suez Canal because of the growing power and development of the Australian trade and the growing civilization of the whole world. I think creating new interests on the part of the United Kingdom, which is only one part of the Empire, is a danger, and I will tell you why : because I think the survival of England depends upon how far common interests, common economy, will lead to the permanent unity of the Empire and to united defence for common interests. All parts of the Empire have a common interest in and will fight for a water-way. I defy anybody to prove, except indirectly through Indian interests, that the Empire will have a common interest in that railway route. I also defy anyone to disprove that the Empire as a whole has not a common interest in the Suez Canal.

Captain CURTIS : Mr. Cust remarked that it should be an international railway. The Suez Canal was supposed to be neutral—how long ? As long as it suited us. I suppose that railway, if it ever exists, will be international, as long as it suits the strongest Power that can seize it to its own advantage.

Mr. FELL, in reply : I wish to make one or two remarks with regard to the observations of Colonel Champain. First, with reference to the traffic of the

Euphrates Valley, I should like to point out that Sir William Andrew estimates the receipts from the through traffic at 406,000*l.*, and 540,000*l.* per annum from the local traffic, making in all 947,000*l.*, and deducting 50 per cent. for the working expenses, there would be left a net revenue of 473,000*l.*

Colonel CHAMPAIN: Might I ask whether Sir William Andrew's calculation refers to the Euphrates or Tigris Valley?

Mr. FELL: I am not in a position to say, and am sorry Sir William is not here this afternoon. This is the estimate he has published; he thoroughly believes in it, and is quite prepared to support it with evidence from Consular reports and other reliable resources.¹ Colonel Champain stated that the distance between the Mediterranean and the Persian Gulf was not 850 miles, as I have given it, but 1,100 miles.

The CHAIRMAN: Perhaps you might reconcile the two statements in this way. The direct line from the nearest point of the Mediterranean to the port of Bussorah would be about 900 miles, whereas a line from one of those ports on the Mediterranean named by these gentlemen leading to the Euphrates, and thence passing down the right bank to Keweyt would be approximately 1,100 miles; while Colonel Champain's little route by Diarbekr and Mosul would be 1,500 or 1,600 miles.

Mr. FELL: That may be the explanation, and so it is possible that we may both be approximately right by taking different routes.

Mr. CUST: He did not say to Bussorah; he said to Grain.

Mr. FELL: General Chesney and Sir John Macneill, who have surveyed the route, make the distance from Alexandretta to Bussorah only 850 miles, and I do not know by what means Colonel Champain can have added 250 miles to that distance. The surveys which have been made show the distance to be about 850 miles, but I cannot say whether the route taken was by the right bank of the Euphrates, or by the Tigris Valley. If the eastern terminus should be at Grain instead of Bussorah, 50 miles would be added to the length of the line, which would then be 900 miles in place of 850 miles. I have not taken any one route in preference to another, but the one of which I have spoken was selected only for the purpose of illustration, and I observed that if the Tigris route was found to be the best when the time came for deciding as to the relative merits of the different routes it would of course be taken. As the Tigris route is the one on which there would be the largest amount of local traffic between Baghdad and other places further west to Bussorah or Grain, I think Sir William Andrew's estimates must have referred to it. There would also be a very considerable local traffic from Aleppo to Alexandretta, and the amount of local traffic above named would pay 3 per cent. upon the entire amount of capital required, so that if the Government gave a guarantee of 3½ per cent. the local traffic alone would nearly cover it. With regard to the speed of travelling on the Euphrates Valley Railway, this would depend on the requirements of the traffic. On the Indian lines no doubt the speeds are slow, and I recollect the time when the Paris, Lyons, and the Mediterranean Company ran their trains from Maçon to Geneva and the Mont Cenis at a speed of less than 20 miles an hour, while they were running the trains to Marseilles at over 40 miles an hour. This latter speed could easily be maintained for the express trains on the Euphrates Valley line, and for the local and other traffic for which high speeds were not necessary slow speeds would of course be adopted on account of their being less expensive. With an average running speed of 40 miles an hour the journey from the Mediterranean to the Persian Gulf would be easily performed in twenty-four hours. Sir Lewis Pelly and other gentlemen have told us that in their opinions the climate along the Euphrates route is not so bad as Colonel Champain appeared to represent it. It is not so far south as the Red Sea, Calcutta, or Madras, and if instead of steaming on the former at 10 miles an hour the journey on the Euphrates line were made at a speed of 40 miles an hour the ventilation caused by that high speed would probably make the Euphrates route a more comfortable one for passengers than the other. With regard to the possible destruction of the line in war-time, it is quite true that the bridges might be blown up if the Russians ever got there, but if Captain

¹ If Colonel Champain has made a lower estimate, will he be kind enough to state on what evidence it has been formed, that we may be able to form an opinion as to the respective value of the two estimates?

Bedford Pim had his way I don't believe they ever would get there. Supposing, however, that some of the bridges were destroyed, the effect would not be the same as the destruction of any part of the Suez Canal, which would require a long time to repair, whereas a railway bridge could very quickly be repaired and made passable by a temporary timber structure. It will be remembered in the Franco-German War the Germans made as much as 30 miles of railway in a very short time in order to pass round Metz, which was then in the possession of the French Army. So that in the case of the Euphrates Valley Railway, even if considerable portions of it should be destroyed, the line could be very quickly repaired and the communications restored, which would not be the case with the Suez Canal if the navigation were once interrupted. It is true that we should have no right to make a railway through Asiatic Turkey without a concession, but we may suppose that the Turkish Government would be willing to give the concession for two reasons. First, that the railway would very much improve and add to the resources of the country through which it would pass, and, next, by thus adding to the resources and vitality of Turkey it would tend to prolong the life of the Sick Man and help the Turks to hold their own as against some of their neighbours for a longer period. There can be no doubt that a railway 850 miles in length through a country that might be inhabited and rendered productive would be a great help to Turkey. Some persons have supposed that the Arabs would be a difficulty, but the Arabs in Turkish Arabia would not be the same difficulty that they have been in the Soudan, but, on the contrary, they might be made of service for the protection of the railway, and, if properly treated and moderately paid, they would be good friends and not enemies, or in any way hostile to the railway.¹

THE CHAIRMAN: I am sure we are all very much indebted to Mr. Fell, and to all the gentlemen who have taken part in this discussion, for their very able remarks. I think we have had the subject pretty well examined from the point of view of British interests and also as an international line. We must all admit that this line connecting the Mediterranean with the head of the Persian Gulf is really a modern expression for a line connecting the East and the West. It pierces right into the heart of Western Central Asia; and no doubt if one main artery were opened there would soon be many ramifications. The climate of Mesopotamia is no doubt very hot. I have resided in the Gulf regions for twelve years, and therefore have some

¹ With regard to the objections that might possibly be raised by France to the concession being given to an English Company, that might be avoided by the French people being invited to join us in the undertaking, in which we might be joint proprietors as we now are in the Suez Canal, proper provision being of course made for the special requirements of India and England. And as regards Turkey, that Government having already granted one concession, and I am told more than one, there appears to be no reason for supposing that they would refuse to give another. Mr. Cust observed that the tone of the paper I have read was rather antagonistic to Russia, and that Russia should be treated as a neighbouring Power, with whom we are on friendly terms—in fact, that we should treat Russia as we would expect her to treat us. Well, we do not in any way depart from that good rule when we take defensive measures for the protection of our rule and interests in India by improving our communications with that country by the Euphrates Valley route. Even if we had the power we have no desire to take away from Russia any part of her territory; we cannot, however, give Russia credit of having the same peaceable disposition towards us, as it is well known that there exists a strong party, and a strong feeling in some classes in Russia, in favour of taking the first opportunity of seizing upon India, which she is acquiring the power to do, or to attempt to do, by each successive move in the direction of Afghanistan. Consequently, although Russia may be quite right in taking no special precautions against an attack from England, we should be quite wrong if we were to neglect to take all the defensive measures within our power to provide against a possible attack of Russia upon India. The two cases of the position of Russia towards England, and the position of England towards Russia, are not parallel cases, and it is an error that may result in the gravest consequences to ignore this significant fact, as unhappily many persons in England appear to do.

experience of the heat ; but the physical aspect of the natives of the country shows that the human race can thrive there. Although Englishmen might not be able to work in that climate, still there are multitudes that could and would be willing to do so. In respect to the climate debarring enterprise, we know that in ancient times the cradle of civilization was in that very region, viz., the Valley of the Tigris and the Euphrates. Perhaps, without diverging into politics, we may attribute something of the present desolation of the Euphrates to the want of regular Government. I do not wish to throw any aspersions on a foreign Government, but I feel certain that with an equitable and civilized Government such as we have in this country those regions would to a great extent revive. The question of Bussorah *versus* Grain as termini is of secondary importance, but we must always bear in mind that Bussorah is 60 miles up the river, and although there is deep water on the Shut-al-Arab, enabling vessels of 2,000 or 3,000 tons burthen to come close alongside the bank, still they have to leave the river through a narrow and somewhat intricate passage before passing into the Persian Gulf proper, whereas at Grain, with one lighthouse, you could at any time go in and out freely. The navigation of the Persian Gulf itself is quite easy ; there is a 30-fathom line right down to its entrance of Mussendôm, where the water deepens through the straits to 50 fathoms, and so speedily to deep sea soundings. Along the coast of Mekran to Kurachi the coast is clear, and the water comparatively smooth during the south-west monsoon, when a heavy sea runs further to the southward.

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Friday, February 15, 1884.

MAJOR-GENERAL SIR ANDREW CLARKE, K.C.M.G., C.B., C.I.E.,
R.E., Inspector-General of Fortifications, and Director of Works,
in the Chair.

OUR FIELD TELEGRAPH; ITS WORK IN RECENT CAMPAIGNS, AND ITS PRESENT ORGANIZATION.

By Lieutenant-Colonel A. C. HAMILTON, R.E.

I. INTRODUCTION.

If I needed any excuse for bringing to your notice the subject now before us, I could hardly find a better one than in the fact that no lecture has, so far as I am aware, been delivered on the subject of Military Telegraphs in this room for about fourteen years.

During that space of time our Field Telegraph has been organized, put to several practical tests on active service, and finally been reorganized; and I feel sure that there are a great many Officers in our Army who must be interested in tracing the development in this most important auxiliary to a military campaign from its infancy to the present date, especially as I believe that I may safely say that its organization, both as regards *personnel* and *matériel*, is now so elastic and efficient that no other Army in Europe, in proportion to its size, is better provided in this respect.

Speaking of other Armies, I wish that time would allow me to give a brief sketch of the various systems that foreign nations have adopted in the organization of their Field Telegraphs, but I may assure you that whatever there was to be learnt from these, and whatever was in any way applicable to our own Army, has been fully considered and seized upon by those to whom has been entrusted the duty of devising the present scheme of organization.

The provision of a sufficiently large and thoroughly expert *personnel* for the Field Telegraphs of an army from purely military resources has been met by most Continental nations where military conscription obtains, by drafting *employés* from the civil telegraphs of the State into the military cadres on the mobilization of an army for war; but such a system would be impossible in England. We are, however, able to overcome any difficulty in this matter by the arrangement which has for some years been in force of lending to the Post Office during peace-time a small body of men belonging to the regular Army, who are employed under their own Officers in the construction,

maintenance, and, to a very limited extent, in the working of the Post Office Telegraphs in the southern districts of England.

This system, so economical both to the military and civil departments, is most effectual in keeping the military telegraphers in a state of efficiency in their technical duties—a matter of vital importance, for there is scarcely any profession in which a man's efficiency more depends upon constant practice than in that of a telegraph manipulator.

I will not take up your time by dilating on the advantages, nay, of the paramount necessity, of establishing telegraphic communication between the headquarters of an army with its base, and between the General in command and the commanders of divisions, brigades, and military posts under him; but I will only point out, what I have learned by actual experience, that during a war in a country where the only postal arrangements are those which have been hastily improvised by the Army itself, almost the whole official correspondence has to be conducted along the telegraph wires; and that, for one message emanating from the commander concerning the movements of the troops, there are from 20 to 40 sent by the Officers of the various departments—Medical, Commissariat, Ordnance Store, &c.—comparatively trivial in themselves, but absolutely necessary to the proper working of the Army in all its branches. The reason for this general dependence on the telegraph is the slowness, the delay, and the uncertainty in the transmission of letters when conveyed from post to post by mounted orderlies (especially in a country where it is unsafe to send these on by night); so that it has become a recognized fact that no military expedition can be undertaken without providing for an efficient telegraph service.

II. HISTORY OF ORGANIZATION UP TO THE PRESENT TIME.

When last this subject was treated of in a lecture at this Institution it was by Colonel (then Captain) Stotherd, R.E., who in May, 1870, described the organization of the Telegraph Troop, then being formed.

The material then carried was 36 miles of a rather heavy cable on twelve wagons, with 3 miles each. The troop was further composed of 4 office wagons, 2 pontoon wagons (to render themselves independent of the pontoon train in crossing rivers), 2 field forges, and 4 store wagons—24 carriages in all. But it was early recognized that such a body was only capable of maintaining the telegraphic touch between the different portions of an army in the actual front, and could not spare any of its very limited material for the lines of communication. It was to be followed by another body of telegraph engineers, whose duty it would be to construct semi-permanent lines. The *personnel* of this force was organized in two companies—the 22nd and 34th—of the Royal Engineers, whose services in peace-time were placed at the disposal of the Postmaster-General for use on the postal telegraphs of England. These units were so organized in the year 1871. But no special transport was provided for these companies, so

that in the event of their being employed on service they would have had to depend upon the general transport of the Army for the carriage of their stores, or upon such local transport as could be got together at the seat of war.

A detail of the stores required for a semi-permanent line of telegraph called an *intermediate* equipment (*i.e.*, intermediate between a Field Telegraph and a permanent one) was got out on paper in 1878.

The troop equipment was left as above described until 1877, about which time the authorities came to the conclusion that it was unwise to depend solely upon insulated cable, seeing that all other European Powers had in their organization provided "air-line" (that is, bare wire supported on poles) in addition to cable, in their respective Field Telegraphs.

(Cable and air-line have each their advantages and disadvantages according to circumstances, and I will briefly point these out.)

Cable has the following advantages: Lightness, rapidity of construction and reeling up, the facility with which it may be concealed, and the ease with which it may be repaired.

Its disadvantages are: Liability to destruction by grass-fires (if not buried), and expense. It used also to be urged against cable that there was great difficulty in finding where a fault lay if the conducting wire were broken inside the insulation, but I must say that I never recollect such a case to have actually occurred with the present service cable.

Overhead line has the great advantage that if the line is anywhere broken down it can be seen immediately where such a fault has occurred; and a repair in such a case can be effected without having to search for the fault. It is therefore more easy to patrol such a line on horseback.

Its disadvantages are, its weight, for it has been found that to get an efficient air-line, the material, including the poles, weighs half as much again as the same length of cable.

Also it is found that in unenclosed countries the poles are very liable to be thrown down and broken by cattle rubbing themselves against them. (This was a constant source of interruption in South Africa.)

(Air-line is very useful for carrying the line into a camp, but if it is only for a short distance cable can be buried 6 inches in the ground, and so laid, it will not be easily injured.)

Therefore, in 1877, the organization of the Telegraph Troop was so far modified that each of the four sections of which it was composed received an air-line wagon carrying $7\frac{1}{2}$ miles of wire and a proportion of poles, while at the same time two cable wagons and two pontoon wagons were reduced, leaving the original number of twenty-four wagons in the whole troop.

Thus the mileage of the latter was increased from 36 to 60 miles, viz., 30 miles of cable on ten wagons, and 30 of air-line on four wagons. At first sight it would appear from this that air-line must be much lighter than cable, but it must be remembered that in those

days a very heavy cable was used, while it has since been proved that $7\frac{1}{2}$ miles of air-line are more than conveniently can be carried on one wagon besides the necessary tools and instruments.

This organization remained in force until the existing one which I shall presently describe came into operation.

III. THE FIELD TELEGRAPH IN RECENT CAMPAIGNS.

When the expedition to Ashantee was sent out under Sir Garnet Wolseley in 1873, it was decided to provide telegraphic communication as the force moved inland, but the Telegraph Troop was not drawn upon either for *personnel* or *matériel*. The party consisted of one Officer, Lieutenant H. Jekyll, and twenty-five non-commissioned officers and men drawn from the 22nd and 34th Companies of the Royal Engineers. They were provided with a special equipment extemporized for the occasion, consisting of No. 11 B.W.G. galvanized iron wire, and insulators of two patterns. For the first 30 miles they employed single-shed earthenware insulators, such as are used on some permanent lines, and beyond that distance light ebonite insulators with bent shanks were used. These had sharp points on the shanks, and were driven into the tops of the poles. For poles they relied on trees and bamboos cut in the bush. The line was constructed to a point about 20 miles beyond the River Prah, that is to say, about 110 miles from the sea-coast. This line worked with great regularity and was left standing in the country when the troops marched down.

In March, 1879, when Lord Chelmsford, after the disaster of Isandhlwana, was organizing his forces for a renewed invasion of Zululand, he telegraphed to England for the Field Telegraph; and one half of "C" troop, Royal Engineers, of which I was at the time in command, was promptly placed under orders for service in South Africa. From what I have told you of the organization of the troop at that time, you will understand that the force being sent out only carried 30 miles of line (fifteen cable and fifteen air-line), though it required a transport specially to convey it to the seat of war.

This amount of line was evidently too small for use in a country where no telegraphs existed, and I was permitted to leave behind the office wagons, and to load up other wagons in their place, in such a way as to take 80 miles in place of 30 without increasing the number of horses or carriages of the half troop.¹ A further reserve of material was not granted, as it was then contemplated that the troop would be followed by one of the telegraph companies off the Post Office with *intermediate* material, but unfortunately this arrangement fell through.

The force embarked was divided into two sections and consisted of—

1 Major.

4 Lieutenants.

¹ For 30 miles, however, we could only take wire and insulators, trusting to find a substitute for poles in the country, in which we were not disappointed, as there were plenty of bamboos growing at Pinetown, near Durban.

- 1 Surgeon.
- 1 Veterinary Surgeon.
- 179 non-commissioned officers and men.
- 110 horses.
- 12 wagons.

Unfortunately twenty-seven horses were lost through a gale in the Bay of Biscay, but these were most efficiently replaced on arriving in Natal by four teams of colonial mules.

The troop disembarked at Durban by the 15th of May, and on the 17th 15 miles of air-line were pushed on with the mule teams to each of the columns.

The horses with the cable were kept back for a few days to recover from the effects of their long voyage.

The colonial telegraphs then in existence are shown on the map (see Plate) in thick lines. Lieutenant Hare commanding the right section with the 1st Division put Fort Pearson in communication with Fort Chelmsford, and Lieutenant MacGregor (who was subsequently killed at the Ingogo River) tapped the colonial line between Ladysmith and Newcastle at a place called Quagga's Kraal, and established a line from thence to Dundee.

The cable detachments, having marched from the base after about a week to rest the horses, joined their sections. The right section completed the line to Port Durnford as the 1st Division advanced, and the left section extended the line from Dundee to Landman's Drift, the advanced depôt of the 2nd Division.

In the meanwhile the Inspector-General of the Line of Communication, as soon as he became aware of the small amount of material sent out, and had heard by telegraph that the departure from England of the Telegraph Company had been countermanded, wired home for an additional 100 miles of line, &c., which was despatched as soon as possible, and which proved of the greatest possible use in the second stage of the expedition.

Short as was the line which had been established by the left section (which on its arrival at Landman's Drift was unable to proceed further for want of sufficient material to reach as far as the next station), yet even this was of the utmost service during the war, first in saving about 40 miles of road by which messages had to travel by post-cart from Ladysmith to Landman's Drift, but also because, fortunately, some heliographs became available, and the Telegraph Troop, having a large number of highly-trained signallers,¹ a chain of signal stations was immediately established connecting Landman's Drift with Itelezi Mountains, Itelezi with Fort Marshall, Fort Marshall with Fort Evelyn, and afterwards with the Entonjaneni range.

These signal stations were all in working order before the Battle of Ulundi was fought, but unfortunately three days of cloud followed that event, and the heliographs, just at the moment they were most

¹ In the last two years they had headed all other corps in the Army in the official Returns.

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required, were useless, and unable to report that victory before the news of it could be brought down by road.

It will be remembered that, after Ulundi was fought, General Newdigate's division marched down country, leaving the posts above-mentioned garrisoned; and, by order of Sir G. Wolseley, who had by that time assumed command, a fresh column, under Colonel Clarke, marched up from Port Durnford to Fort Victoria and Ulundi. The 100 miles of reserve material having arrived, Lieutenant Hare provided himself with fifty, and proceeded to lay a line with the assistance of the Natal Native Pioneers.

This line was pushed on with considerable rapidity, considering that rough poles had to be cut and transported some distance, and it was found that the wire would just reach as far as a hill beyond Fort Victoria, from whence Sir Garnet Wolseley's camp at Ulundi, 10 miles distant, could be seen. Here the terminal station was fixed, and the messages passed on by heliograph from sunrise to sunset, and by lime-light from 8 P.M. to midnight.

A very large and useful amount of work was carried on by this line, including all the correspondence on the arrangements for re-embarking the troops for England. The time gained in making these arrangements by telegraph must alone have recouped the public the whole cost of the field telegraph service for the campaign, by savings in the cost of hire and detention of transports, &c.

At the same time as Zululand was being finally evacuated, it was also determined to locate some troops in the most healthy parts of the south of the Transvaal, and orders were given for the erection of a line from Utrecht (an office on the colonial permanent line) to Wakkerstroom. This line was erected by the left section with the other half of the reserve material recently received from England, and was left standing when the troop immediately afterwards re-embarked for home.

This being the first campaign in which the troop had been engaged, it was natural that many defects should have been discovered in an untried equipment, and that alterations should have been proposed.

The result of the reports made on this subject was that a Committee was appointed in 1880 to report on the whole subject and propose a complete scheme.

This Committee had only just sent in its report when the outbreak of the Boers in the Transvaal occurred in December, 1880. A section on the new organization was immediately equipped, formed from the troop and the companies in about equal proportions, and despatched with a large reserve of material.

Although this section did not arrive in Natal until after the armistice was concluded, yet the work they subsequently carried out was so complete and so extensive that great experience was gained, and the advantages of the new organization (which I shall explain in detail further on) were fully proved.

The section consisted of 2 Officers (Lieutenant Bagnold, from the companies, in command, and Lieutenant Lindsay, from the troop), and 52 non-commissioned officers and men, and the material was the

equipment of a cable section, and 60 miles of cable, besides 100 miles of "overhead" or air-line stores.

They landed on the 5th April, 1881, and by the 28th had transported their stores to Newcastle, the advanced base of operations, and awaited orders.

Newcastle was then in communication with Pretoria by a chain of signal stations, but on the 14th May Lieutenant Bagnold received orders to erect a line to Heidelberg, a distance of 100 miles, which was most successfully accomplished in thirteen days. On arrival at Heidelberg the permanent colonial line, which had been entirely destroyed thus far, was found to be in working order, and communication was thus directly established between Pretoria and Durban, and thence to England, *via* Aden, by the submarine cable then recently laid.

This line was maintained and worked till the following November, when it was handed over to the Boer Government (who, however, made no use of it), and the section marched south, homeward bound.

It was recorded that during the time this line was in use the number of words signalled was about 1,116,000 (which, at the rate of twenty words to a message, would be 10,000 a month, or 333 per diem). Private and press messages were charged for, which brought in a revenue of 1,170*l*.

A very complete description of the work performed by this section is to be found in the "Journal of the Society of Telegraph Engineers," vol. xi, 1882, in a lecture by Lieutenant Bagnold, R.E.

The experience gained by the protracted maintenance of the field telegraph in the Transvaal, where exceptional difficulties through storms, lightning, grass-fires, cattle, &c., had to be encountered, was used in the further development of the new organization; so that when, in the summer of 1882, the expedition to Egypt was resolved on, four sections on the new model (one of cable and three of air-line) were detailed for service with the Army.

This force consisted of 7 Officers and 184 non-commissioned officers and men, and 65 horses, the whole under the command of Major Sir Arthur Mackworth, R.E. 2 Officers and 61 men were drafted from the companies, and the remainder from the troop.

On their arrival at Ismaïlia on the 28th August, it was found that General Graham's Brigade had been pushed on to Kassassin, 22 miles distant, and that he was without telegraphic communication with his base. The lines of telegraph along the railway had been destroyed or much damaged by the enemy, and the first efforts made were to restore these. Considerable time was spent in landing stores, but by midday on the 1st September a line was got through from Ismaïlia to Kassassin. The line to Suez was next restored, and during the subsequent days additional lines along the railway were got into order.

On the 7th September a small detachment with cable was taken out on a reconnaissance against the enemy, and on the 9th, when the camp was attacked, that of the Field Telegraph Corps came under a

heavy shell fire, during which messages were despatched for reinforcements.

On the night of the 12th September the Telegraph Corps took part in the march on Tel-el-Kebir, the cable section paying out their line during the advance, and keeping as near as possible to the head-quarter staff. At the opening of the action the Telegraph Corps was found to be within range of the enemy's fire, and was ordered to retire a little by Sir Garnet Wolseley. As soon as the battle was over, orders were given to carry the line forward to the railway station, and three miles were accomplished through deep sand in half-an-hour. On arrival there the news of the victory was telegraphed to the Queen at 8.30 A.M., and Her Majesty's reply was received back at 9.15. All the messages that day were sent on the vibrating transmitter. By 6 P.M. that day the permanent telegraph lines had been restored, and the work on the temporary lines was practically concluded; but the Field Telegraph Corps continued for some days to do most useful and necessary work on the Egyptian lines, occupying the various telegraph offices as the troops advanced on Cairo.

I have been unable to give any details of the very efficient work which was carried on during the campaigns in Afghanistan by the Indian field telegraphs, owing to want of information on the subject, but it is well known to all how thoroughly communication was maintained in that war, both by the electric telegraph and by the heliograph.

IV. PRESENT ORGANIZATION.

I now come to the present organization of our Field Telegraph Corps.

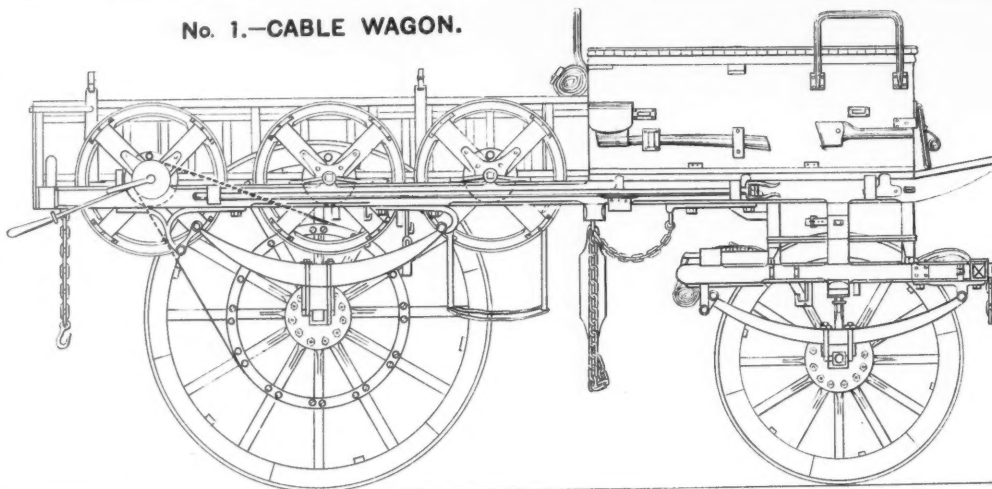
Officially it is but of recent date, as the details, though in print, are not yet published in the Army Circulars; but practically it has been tried on two occasions already referred to, namely, in the expedition sent against the Transvaal Boers in 1881, and in the late Egyptian War.

The unit of the present organization is called a section. It consists of one Officer and fifty-three non-commissioned officers and men, with four wagons of material each with six-horse teams.

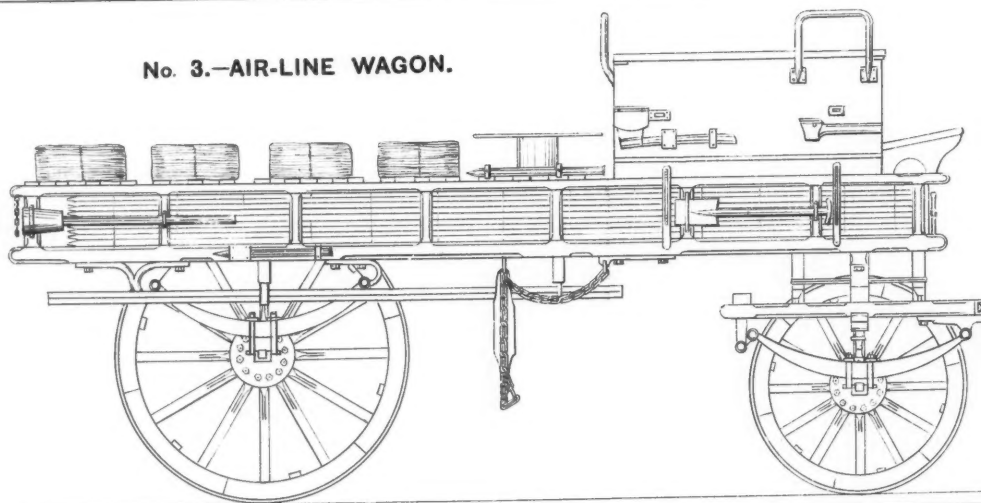
Such a section is equipped as regards telegraph material with 20 miles of line, and three complete telegraph offices. It may be provided with cable or air-line, and the cable may either be carried in wagons or on pack animals.

But the work that a section of the Field Telegraph can perform is not limited to the actual material carried on its own wagons. When this has been expended, the wagons can be refilled with similar stores again and again, provided that railways, canals, or other local or pre-arranged transport can be utilized for bringing up to the front additional *units of material*. The limit to its capabilities has been fixed at four more units of 20 miles of line each, but it is recognized that this is the extreme limit; and that the *personnel* of a section would be taxed to the utmost in maintaining and working a line of

No. 1.—CABLE WAGON.



No. 3.—AIR-LINE WAGON.



No. 4.—AIR-LINE S

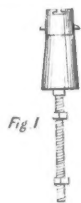


Fig. 1.

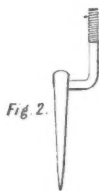


Fig. 2.



Fig. 3.

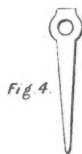


Fig. 4.

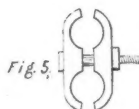
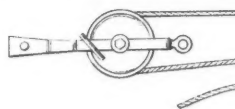


Fig. 5.



No. 2.—CABLE SECTION.

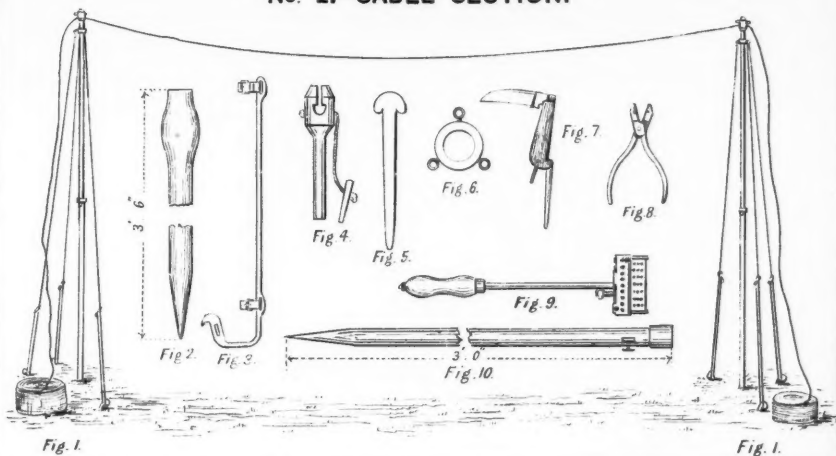


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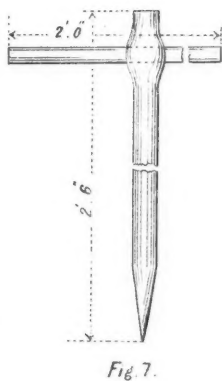


Fig. 7.

R-LINE SECTION.

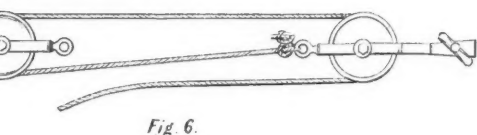
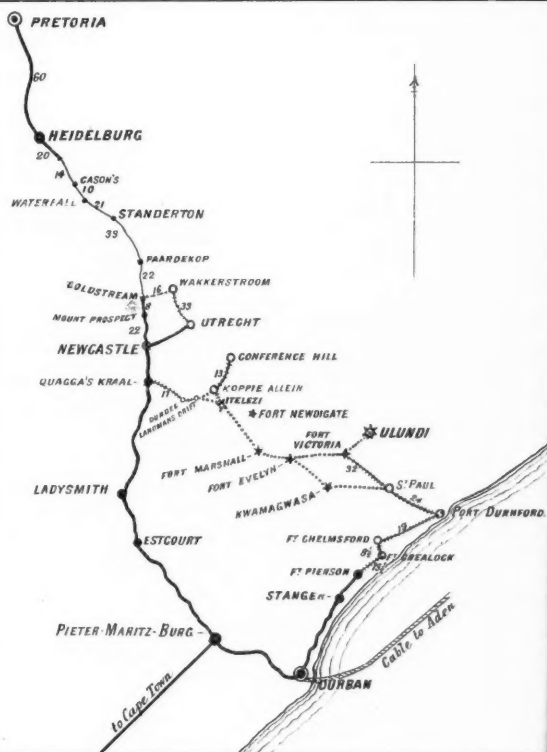


Fig. 6.



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100 miles in length. This has, however, been done in the case of the Transvaal line already alluded to, so the capability of the system has been fully proved.

Personnel.—This, as I have stated, consists of one Officer and fifty-three non-commissioned officers and men. These on the peace establishment are serving either in the "C" Troop or the 22nd and 34th Companies of the Royal Engineers, or are in the Army Reserve. The former is usually stationed at Aldershot, and is regularly trained in Field Telegraph exercises in conjunction with troops of other arms at that station. The latter are employed under the Postmaster-General in the maintenance of the postal telegraphs in the south of England.

Of the fifty-three non-commissioned officers and men forming a section, twenty-eight are mounted men, either drivers or mounted line-men, who are trained in the maintenance of the line, repairing faults, &c., and also in the practice of visual signalling.

The remaining twenty-five are dismounted men, and of these about one-third are furnished by the troop, and two-thirds by the telegraph companies. These latter being constantly employed at their technical duties are highly trained clerks and constructors.

Besides the men formed into sections a small headquarter staff is also organized, consisting of clerks, instrument artificers, &c., which would accompany the working section to the seat of war, and be probably stationed at the base of operations or some important point on the line of communication. The instrument artificers are provided with a very complete kit of tools and materials for repairing every description of telegraph instruments, thus avoiding the necessity of sending any that might get out of order away from the seat of war for repairs.

The troop and two companies are capable of forming eight such sections by calling up the men of the 1st Class Army Reserve that have been trained in those cadres.

Any of these eight sections might be equipped with cable or air-line material, but the proportions it has been decided to provide are two with cable and six with air-line, the extra equipment for placing the cable on pack animals being kept in store ready to exchange for the wagons should the nature of the country in which it is proposed to operate be such as to render that mode of transport more appropriate.

Matériel.—I will now briefly describe in detail the equipment used by each kind of section.

Cable Sections.—The material, camp equipage, artificers' tools, &c., of a cable section are carried in four wagons, each with six horses, and two spare pairs are provided for contingencies.

Two of these wagons are of a special pattern, called cable wagons, and carry each six drums of cable of five-sixths of a mile on the drum, or a total of 5 miles on each wagon. In addition to this the wagon carries all tools necessary for the construction of the line, twelve iron telescopic poles for passing the cable over main roads, a light ladder, a hand-barrow for paying out or reeling up the wire over any portion

of the route where the wagon could not pass, and instruments and batteries for one office. The wagon boxes which contain the instruments and small stores form seats on which the detachment of one non-commissioned officer and six men employed in constructing the line can be carried, in the event of the wagon having to be pushed on rapidly.

The wagon boxes are also so arranged and fitted that a small tent on light rods can be erected over them, and thus form an office in the field where the telegraphers can work sheltered from rain, wind, or sun.

The two hind drums have an arrangement by which they can be automatically revolved when the wagon is in motion, and thus the cable can be reeled up with great facility and rapidity. The arrangement is shown in Plate No. 1.

The third wagon of a cable section is called the cable store wagon. It is a general service wagon of the R.E. pattern on springs, and is fitted up to carry twelve drums of cable, equal to 10 miles. In the front box of this wagon there is carried a complete equipment for a third office.

The fourth wagon is a general service wagon, loaded with artificers' tools, including a small forge, materials for repair, camp equipage for the section, with space for rations, &c.

The section is thus complete in itself, and able to move independently and erect or dismantle a line of telegraph of 20 miles.

No. 2 gives illustrations of the stores and appliances used for the construction of cable lines. Fig. 1 represents the iron telescopic pole in two pieces used for crossings. It consists of two tubes, each 10 feet long, the smaller being carried inside the larger. When used the inner tube is drawn out and reversed, and the two combined form a pole 18 feet high. A wooden socket is fixed in the top, and the cable is wedged into a notch. Holes having been made in the ground, a pair of poles, one on each side of the road, are raised simultaneously, and they are then steadied by three light guy ropes, each fastened to the ground by iron pickets as shown in Fig. 1.

It is not considered necessary to use poles at every cross road that is passed. Where there is little traffic the cable is buried, having been first protected from injury by pieces of india-rubber tubing of the consistency of hose-pipe, but when the road to be crossed is a hard macadamized one it is necessary to use the poles.

A well drilled detachment will construct such a crossing in two minutes.

Fig. 5 shows the iron pickets used, and Fig. 4 the wooden sockets to hold the cable.

But the most important article of equipment is naturally the cable itself. Here we have only followed in the footsteps of other European armies, for we found that the Germans, Austrians, and other Continental nations were adopting a new cable brought out by Messrs. Siemens Brothers.

This cable consists of a seven-strand wire, of which the centre one is of tinned soft steel and the other six of tinned copper, each strand

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being two-hundredths of an inch in diameter. The steel strand gives tensile strength, and the copper strands high electrical conductivity. These wires are insulated with a special arrangement of india-rubber, known as Hooper's core, then covered with paraffined tape, braided with Italian hemp, and drawn through a tar compound. Thus completed, the cable has a diameter of about a quarter of an inch. Its weight is 170 lbs. to the statute mile, and it is capable of resisting a breaking strain of 250 lbs. It has an electrical resistance of 20 ohms per mile.

The next point of importance is the method of making joints, and here the former system of complicated ebonite jointers, still retained in Continental field telegraphs, has been abandoned in favour of the simple method of making a joint with the ends of bare wire stripped of their insulating covering, and drawing over the joint a short piece of india-rubber hose-pipe similar to that used for protecting the cable at underground road crossings. Simple and rude as the process may appear, it makes so good a joint that this may be left under water for some hours before any leak occurs in the electric current. I need not say that in practice so severe a test is never applied; for if two lengths of cable have to be jointed at a spot where the ground is marshy, the joint is usually kept off the ground by supporting in on a bush or stone, or tuft of grass. In order to resist any strain on the joint it is customary also to make a loop in the cable, and tie it together with a piece of spun yarn.

The cable is carried on plain deal drums, and is so supplied by the manufacturers, rough battens being nailed from side to side of the drum to protect the cable during transport on board ship, &c. These are knocked off when about to be used on the cable wagons. Each cable wagon is provided with a barrow, on which a drum of cable can be carried on paths too narrow for the wagon to pass over. This barrow, which is also used in the air-line sections, will be described under that head, as it is more especially adapted and necessary in the case of bare wire.

The ordinary rate at which a line of cable can be laid, allowing for occasional road crossings, is three miles an hour—the rate at which infantry march—but the cable can be paid out at a trot. The line can be dismantled at the same rate that it can be erected.

Air-line Section.—The equipment of an air-line section is carried on four wagons with six-horse teams.

Three of these wagons are of special construction, designed to carry the materials of the line, including the poles, which are 13 feet long. The first two wagons carry stores for 6 miles, each with all tools necessary for the construction of the line, but the third wagon carries no tools, the load being made up with 8 miles of material in place of 6 miles. Each of these wagons also carries a complete equipment for one telegraph office.

The fourth is a general service wagon, and carries precisely the same stores as the fourth wagon of a cable section.

No. 3 represents an air-line wagon of the present pattern, but it is contemplated to design a new pattern which will have several

improvements. It will be seen that its shape is mainly due to the length of the poles which have to be carried. These are withdrawn from the rear of the wagons as required. The insulators are carried in the wagon-boxes, and the wire is lashed to the top of the wagon. The necessary tools for constructing the line are strapped to the outside of the wagon so as to be easily got at.

Poles.—The poles are of pine, 2 inches at the base, $1\frac{1}{2}$ at the top, and weigh $6\frac{1}{2}$ lbs. each. They are painted in alternate bands of black and white, so as to be easily distinguished at a distance. It has been determined that, in future, the poles for these sections shall be of bamboo, which will only weigh on an average $4\frac{1}{2}$ lbs., but the supply has not yet been received from Hong Kong.

These poles are set up by putting the ends into holes about 1 foot 6 inches deep, which are made in the ground with a 2-inch jumper and sledge-hammer.

As the wire hangs with a considerable sag or curve, it is found that it is suspended midway between two poles at about 10 feet from the ground, and often nearer; and as this height is not considered a safe one over a road, special arrangements have to be made in such cases. A certain number of poles, 6 feet long, are carried and used for lengthening those on each side of a road crossing. These are attached to the 13-foot poles by an ingenious arrangement of clips (No. 4, Fig. 5), which have been copied from the Austrian field telegraphs.

Terminal poles, and those at any bend in the line, require special support, which is given by stay wires.

The stays, in place of being fastened to pickets, are made fast to anchors, which consist of short pieces of wood about 2 inches long, with a wire lashed round them, and inserted in a hole in the ground made with the jumper. The stay is then made fast to a loop in the anchor wire. This simple contrivance has been found to give most excellent results in all sorts of soils.

Even when the line is quite straight it is advantageous to stay occasional poles, some right and left, to prevent the whole line being blown over sideways by high winds, and occasionally also by stays front and rear to prevent the fall of the poles in those directions in the event of the line wire being accidentally broken.

Insulators.—The insulators used in conjunction with these poles are of ebonite, with brass caps specially devised to grip the wire, and straight galvanized iron shanks to screw into the tops of the poles.

Fig. 1 shows the Service insulator.

There is another pattern, of which a small number are taken in each wagon, called the *hanging insulator*, Fig. 3, and may be used to suspend the wire from branches of trees, &c. It has another use, viz., as a shackle. In such a case it is inserted in the line at any spot where it may be convenient to test the line in either direction or to insert a telegraph instrument or galvanometer. A couple of leads or pieces of cable are attached to the line wire on each side of the shackle, and jointed near the ground in the usual way. If an instrument is

inserted in place of the joint it will be in circuit. A few bent shanks, Fig. 2, are also carried, to be used instead of straight ones, whereby the insulators may be nailed to trees or walls.

Spike brackets, Fig. 4, are also carried, which are used for the same purpose. These have an eye through which the straight shank of an insulator is inserted and made fast with a nut.

Wire.—After many experiments it has been determined to use as a line wire a three-strand iron or steel galvanized one, each strand being of 18 B.W.G. It has a weight of 95 lbs. per statute mile, an electrical resistance of 45 ohms per mile, and a breaking strain in the case of iron of 320 lbs., and in that of steel of 460 lbs. Both descriptions are in the Service.

Before this wire was finally adopted, many other descriptions had been tried; soft copper wire gave excellent results so far as electrical conductivity was concerned. It is light and easily manipulated, especially in making joints, but on service in South Africa it was found to expand very much under the extreme heat of the sun without contracting equally at night, so that daily it stretched more and more and required constantly to be strained up, and the wire in consequence became thinner and weaker. The value of the copper, too, offered great temptations to theft by the natives, and on several occasions long stretches were carried off.

A compound steel and copper wire was also tried, and at first gave great promise as a valuable description for Field Telegraphs, as the steel gave it great strength, while the copper gave good conductivity. It was formed of a steel wire coated with copper and tinned on the surface. But this was found after a time to deteriorate, as after a little rough handling the steel and copper became separated in places, and the moisture getting into the cracks caused a galvanic action to set up, whereby the steel was oxidized, and the wire weakened at these points. Moreover, it was an article requiring special manufacture for this purpose, and could not be obtained in large quantities at short notice, and it was very expensive.

A simple contrivance has been introduced to enable one man to repair a break in the wire, or take up the slack in a line where it sags or droops. This is the "Apparatus for repairing Field Telegraphs," No. 4, Fig. 6, and consists of a pair of small blocks attached to hand vices. The workman grips the two broken wires at a little distance from the loose ends by the vices, and draws the blocks together by means of a light cord. When sufficiently strained he makes fast the cord on the cleats provided on one of the vices, and easily joints the wires, then detaches the apparatus by the thumbscrews of the vices.

A barrow for carrying a drum of wire forms part of the equipment of an air-line wagon. It is adapted for use either as a hand or wheelbarrow. In the former case it is carried by two men, and the wheels can be detached.

In reeling up the wire a third man is required to turn a winch-handle, which can be attached to the spindle of the drum.

A crook-stick is carried for the purpose of disentangling the wire

from branches of trees, &c. It is a light lance shaft, 8 feet long, with a spring crook at the end.

A couple of sledge-hammers and jumpers are carried to make the holes in the ground to receive the poles. The jumper, Fig. 7, has an eye near the top through which an extracting-bar is passed to facilitate the withdrawal of the jumper from the ground. In hard soils the wear and tear of these jumpers is very great, and spare ones have consequently to be provided.

The detachment necessary to construct an overhead or air-line consists of one non-commissioned officer and eight men, besides one Officer or non-commissioned officer to go ahead and mark out the direction of the line. In an open country non-commissioned officers must be mounted, and it is found convenient that he should go ahead about a half-mile at a time and mark out the direction with a signalling flag (of which a certain number are carried by each section).

Of the detachment two men carry the sledge-hammer and jumper, and make holes for the poles.

Two more carry the wire on the barrow.

Two men strain the wire, relieving each other alternately by taking it up every 70 paces successively, that being the normal distance between the poles.

A seventh man binds the wire to the insulators when necessary, and erects the poles.

The eighth man is employed in taking the poles from the wagon, and placing them at the holes, fixing an insulator in each.

The non-commissioned officer follows in rear, and is responsible that he leaves the work well executed as he proceeds on.

Under favourable circumstances such a line can be erected at the rate of 2 miles in the hour, but difficulties and accidents to the line frequently occur, besides delays if many angles are necessary, so that more than 1 mile an hour cannot always be calculated on.

The line can be taken down almost as fast as the men can march.

Among the implements used in these air-line and cable sections are pole-climbers, No. 2, Fig. 3. With the aid of a pair of these attached to his feet, a man can climb a pole or tree with great facility, and fix an insulator or bind in the wire.

No. 2, Fig. 9, represents a "Fletcher's soldering apparatus" for making joints on permanent lines.

Mountain Equipment.—The mountain equipment is only intended for use in the event of operations being carried on in a district where wheeled transport is not possible, and it may be looked on as an alternative method of transporting the same material as that used in the cable section.

Owing to the difficulty in carrying the 13-foot poles upon pack animals it has been decided to employ cable only in the mountain sections. Moreover, the ground where only pack animals can be used is usually rocky, and as such unsuitable for erecting the poles. The number of men in such a section is the same as in the others, but in place of wagons fifty pack animals are provided. These are detailed as follows:—

	Mules or horses.
To carry 20 miles of cable	28
„ tools for constructing line	2
„ stores and instruments for 3 offices...	3
„ camp equipment and Officers' baggage	3
„ stores, 1; men's kits and blankets, 6; } men's rations, 3; mules' rations, 4 }	14
Total.....	50

The cable is carried on small drums in lengths of five-fourteenths of a mile, or 630 yards. These drums fit into small leather panniers, and hang one on each side of a pack-saddle. The cable is of the same description as that carried in the cable section. The equipment for each office forms the load for one mule. It is packed in a pair of boxes of a tough light substance called "Clarkson's Material." One box contains the instruments, stationery, &c., and the other the voltaic batteries.

The equipment is reduced as far as possible to diminish the transport, and only the lighter and more portable instruments are taken on mountain service.

Office Equipment.—The time at my disposal will not permit me to go into any detail concerning the instruments used in our Field Telegraphs. But as these form such an important part of the organization I will briefly enumerate them, and point out the special circumstances for which they are adapted. Each of the three offices of a section is very liberally equipped in this particular, thereby giving the possibility on special occasions of establishing a large number of offices, by subdividing the office stores.

The instruments are—

A Morse recorder.

A sounder.

A vibrating transmitter.

A relay.

A switch.

Three telephones.

A galvanometer (single and duplex) and a detector galvanometer for the use of the line-man examining the line for a fault.

A single-current key, and

An electric bell.

The Morse recorder on the table has been specially designed for use in the Field Telegraphs, being very compact, and fitting into a wooden case, which can be partially opened so as to permit the operator working at it in the rain without exposing the instrument very much.

The special advantage claimed for a recorder is that it records the messages received on a narrow slip of paper, which is paid out by clockwork.

The disadvantage in this instrument for use in the field is its weight, together with the large stores of recording paper and the

special ink which must be taken with it. For this reason it has been omitted from the mountain equipment.

The next instrument is the sounder—a very simple and compact one, capable of being used alternatively with the recorder. With this instrument the receiving clerk reads the message by ear in place of taking it off the slip. With thoroughly trained clerks this is a positive advantage, as a man pays his undivided attention to what he is listening to, and writes down as from dictation, in place of copying from the slip on to the message form.

The instrument fits into a leather case, and may be carried by a strap over the shoulder.

Both the recorder and sounder are constructed so that by the turning of a switch they can be worked either by a continuous or intermittent current.

The next instrument on our list is the “vibrating transmitter,” and is used in connection with a telephone at the receiving end. It has been introduced into our field telegraphs on account of the marvellous power which this arrangement has for being used on a defective line, so that in such a case as a bare wire lying on the ground, from the poles being knocked down or (as was sometimes the case in South Africa) the insulation being burnt off the cable by grass-fires, the transmitter would convey messages with great distinctness, whereas there would be an insufficient current received to work a recorder or a sounder. But the instrument has some defects, owing to its great sensitiveness, which render it, however useful on special occasions, unsuitable to the ordinary traffic of the service.

The relay is an instrument that will work with a very weak current. When so worked it sets in operation a local battery, which, acting on a local instrument, such as a recorder or sounder (or on a line-wire to a distant station) produces the same result as if a powerful current had been received.

The switch is a simple arrangement for diverting the current from one line to another. This is used in setting up a translating station.

The telephone receivers are of the Ader pattern.

The detector galvanometer is a small light instrument, carried in a leather case over the line-man's shoulder whenever he goes out to detect and repair faults. By applying it to the wire he is able to detect if the line is in working order between himself and the next station.

A large single-current key has been added to the equipment for use at stations where a very large amount of traffic is done. It is far less fatiguing to the operator to work with this than with the little keys belonging to the instrument. This is an important point when men have to work many hours at a stretch.

Every office is also provided with a keyless German silver watch, and an electric bell, which can be connected to the instrument, so as to call the clerk if he is wanted.

The batteries used are made up of ten or six cells of a special form of Leclanché battery, suitable to rough transport.

Every office has also an “earth-pipe,” No. 2, Fig. 10, which is driven into the ground, so as to reach the damp subsoil.

Reserve Units of Stores, &c.

As I mentioned in my introduction, each section of the Field Telegraph Corps would be followed by a certain number of units of material of 20 miles each, say two, three, or four, according to the peculiarities of the campaign, and reserve office units, one for every 10 miles of this reserve material, would also be sent out.

Suffice it to say that a reserve unit of cable would weigh 2 tons, one of air-line would weigh 3 tons, and a reserve office 3 cwt., inclusive of boxes, packing-cases, &c., but not including stationery.

Stationery.

A few words on the stationery required.

The amount of work which a line of military telegraph in the field has to perform, and the consequent expenditure of telegraph forms, has been found by actual experience to be so large as to be hardly credited by those who have not studied the subject. It is nevertheless true that four sections such as were sent out to Egypt last year would require three tons of telegraph forms and other stationery to meet the probable expenditure of three months. The weight has therefore been reduced as much as possible by using the thinnest paper that could be considered serviceable. The message forms are printed on paper of three colours. White is used for the sender to write his message on; pink is used at the office where the message is received, where it is written in duplicate by means of carbonic paper, one copy being sent to the addressee and one copy kept in the office; the third form is yellow, and is only used in telegraph offices where there are two or more instruments, where messages received on the one have to be transmitted by another.

It is most desirable that all Officers of the Army using the military telegraph should be impressed with the necessity of using the forms provided for the purpose, and not writing their messages on pieces of plain paper.

The telegraph sections are further all equipped with day-signalling apparatus, viz., flags and heliographs. The latter are especially useful in bridging over any portion of the telegraph line which may have been damaged by accident or by the enemy.

V.—PRACTICAL APPLICATION OF THE NEW ORGANIZATION.

I will conclude with a few remarks on the application of the organization I have just described to possible future campaigns.

The wars in which England is from time to time engaged vary so greatly in size and in all other characteristics, that nothing but the most elastic organization will suit all cases. I will therefore take two or three imaginary cases as specimens of what might be required.

Case I.—A complete army corps is to be landed in a country where few if any permanent lines of telegraph exist, and will have to march 200 miles before arriving at the probable scene of operations (such a case might occur if operations were to be conducted in Asia Minor

with a base at Alexandretta, in the Gulf of Iskanderun). Now for such a campaign the least that we could take would be four sections—one of cable or of mountain equipment and three of air-line.

Here I wish to remark that there is no necessity whatever for all these sections to be embarked together from England in one transport, and far less is there for all their reserve stores to accompany them. Such a course can only hamper the operations of the Telegraph Corps, for while engaged in disembarking their stores and safely housing them, the advanced line of telegraph should already have been in operation.

I would strongly urge that in any future campaign the cable section (with one or two reserve units of material) should accompany the very first troops landed at the seat of war; so that there should be no recurrence of the disadvantageous situation which was witnessed in the late Egyptian Campaign, when Graham's Brigade was left at Kassassin for many days without telegraphic communication with his base, or even with the cavalry brigade 4 miles in rear of him. In this case the whole Field Telegraph Corps was embarked on one slow transport, and did not arrive at Ismailia till several days after the operations had begun.

Even should there be no fighting, the cable section will find ample work at the base while the army is being landed.

A sanitarium may have to be established at some more healthy place than the sea-coast. The cavalry may have to be sent to some higher ground, where there is better grass; and the various dépôts and departmental offices established in the most suitable situations; and all these should immediately be placed in telegraphic communication.

Having accomplished such duties, the cable section will refit from its reserve stores, and prepare to place itself on the line of march with the advanced troops of the army.

In the meanwhile one or more sections of "air-line" will have landed, each with two or three reserve units of material, for though four per section are provided in store, it must be considered as an extreme case that a section should maintain 100 miles of field-line. A certain amount of local transport must be assigned to these reserve stores, so that at the end of each day's work the telegraph wagons may be replenished.

No doubt if there were three sections present they could erect the first 60 miles without drawing on the reserves, but then there would be no more to go on with, so that it would be better, if possible, to let one section do the work up to a certain point, and then take charge of what it had erected.

I think we may take 12 miles a-day as very good marching for an army, and an "air-line" section can well accomplish this by setting a detachment with No. 1 wagon to work from the starting point, and sending on another detachment and No. 2 wagon with the advanced guard to begin work 6 miles further on. As it will take from three to four hours to erect 6 miles, it may be expected that the new camp will be in telegraphic communication with the base within two hours of the

main body of the troops arriving at their camping grounds. Should the camps of the various brigades and divisions be scattered, owing to the exigencies of the grass or water supply, or any other reason, it will be the duty of the cable section to connect these up. They will have the duty of picking up such cables the next morning at day-break, following the rear of the troops, and repeating the duty on arrival at the next camp; but if no great amount of such temporary work were required the half sections might be employed in this way on alternate days. This would still provide 10 miles for such lateral communication.

In this way the march of the army would be followed till every section had charge of the maintenance of 60 to 80 miles. Telegraph stations would be established at every post on the road, and from these posts line-men would patrol backwards and forwards half-way to the next post.

Arrived in the presence of the enemy, the circumstances of the case will decide what further use can be made of the Field Telegraph, always remembering that the cable section, which should be kept intact to the last, can move and work as fast as the troops can march, and can even with safety be taken on a reconnaissance.

Case II.—An army (as in the late Zulu War) is moving in two columns in the enemy's country from points already connected by a permanent line of telegraph. The distance from the ends of the permanent line to the objective point, *i.e.*, the enemy's capital, is about 100 miles.

In this instance four sections should also be employed; but, in place of one of cable and three of air-line, I would recommend two of each.

The cable sections with two units of reserve stores would keep with the leading brigades, or at least with the headquarters of each column. The air-line sections would follow their columns and bring up the line from day to day, as in Case I.

Should the time come for a dash by troops lightly equipped on the enemy's town, as is sometimes the case in such expeditions, the cable would be there to accompany the troops, and report the result.

I have not referred in these cases to the part that signalling would play in such expeditions. In my opinion, it should work entirely in conjunction with the military telegraph, so as to complete such portions of the network of communications as are most suitable to that method of sending messages.

Case III.—In the event of our being involved in a war in a highly civilized country where there already existed a network of permanent telegraphs, and that we despatched two army corps, the eight sections which we are capable of mobilizing might be distributed thus:—Two cable sections each with two reserve units of material; four air-line sections each with two or three reserve units ready at advanced depôts for distribution, as they might be required, to replenish the section wagons; and the remaining two sections might give into store their three technical or air-line wagons, draw in their place ordinary store or general service wagons, loading these with a suitable assort-

ment of wire, insulators, and other stores for the maintenance of permanent lines, an abundance of which would be available from the stores belonging to the Post Office in this country, or to the State Department of the country in which operations were being carried on.

The cable sections would in this, as in all other cases, remain with the fighting line of the army, connecting army corps with their divisions, &c. The duty of the air-line sections would be to connect the headquarters of the army with the nearest offices on the permanent lines of the country which might be in communication with the base.

The sections specially equipped for repairing permanent lines would, in the case of a line of telegraph destroyed by a retreating enemy, probably have only to refix wires cut here and there; for the total demolition of the poles would be a labour too arduous and requiring too much time for any army during a retreat; and they would take charge of all the permanent lines in the rear of the army.

Thus an organization has been planned and carried out which provides for a Field Telegraph force suitable for the smallest as for the largest war that could be undertaken by this country.

Colonel WEBBER, R.E. : There are so many other Officers here who are equally interested with me in the subject, that I should prefer if you would ask them to begin, but one's experience of the Institution is that, unless somebody does begin, the discussion hangs fire; therefore, at your call, Sir, I will make the few remarks which have occurred to me in reading Colonel Hamilton's interesting paper before the meeting, and also in hearing it read. The information which he gave us at the beginning of the paper, that the last time a paper on telegraphs had been read at this Institution, was when Colonel Stothard read an account of the then existing field telegraph, rather startled me, because I really thought that through the Journal of this Institution the Army had been kept better informed of the growth of military telegraphy in this country. I can only say it is not a day too soon that Colonel Hamilton has taken the trouble to compile and put before us the interesting body of information which we have just heard read. I should like to correct one little item, a very unimportant one, in his historical account, and that is that the Great Eastern cable to Durban was only laid at the beginning of the outbreak of the Boer War. The fact is that the first message that passed over that cable was in December, 1879, and as the proceedings of this Institution are matters of record, perhaps the audience will not mind my having publicly corrected him on that point, particularly as the historian of military telegraphy is now present, I mean Herr von Fischer Treuenfeld, who has, as a labour of love for many years, collected a large mass of information on this subject, and put it together, not only as regards his own land, but as to all countries. Colonel Hamilton did not allude to the experience gained in field telegraphing and its connection with signalling during our manœuvres, probably from want of time, but I think that the work that was done, not only at the manœuvres at Salisbury in 1872, but also at Dartmoor and elsewhere, tended very much to provide information and experience upon which the numerous recommendations were founded that have since been applied to its equipment, and probably rendered it one of the most perfect equipments that we have in the world. He alluded to the work of Captain Evans of the 23rd Fusiliers in the Utrecht district, and as that Officer is present, and probably on account of his well-known modesty, will not tell of what he did, I think it will be no harm if I tell you. He took over the charge of a telegraph line built originally under circumstances of considerable difficulty, and subject to the influences which Colonel Hamilton has described, of grass-fires, cattle, Boers, and other such obnoxious things, and with the help of two or three men of the 58th Regiment, he worked and maintained that telegraph line for

several months. He also, when you may say it was completely worn out (not by the number of messages that went over it, for they were not very numerous), removed that line and used the material, or a large portion of it, to build a line between Wakkerstroom and Coldstream, a distance, I think, of 19 miles. In that operation he had the advantage of using bamboo poles which had been presented to the British Government by the Emperor of Brazil, and had been sent in one of the mule steamers from Rio to Durban. I had great pleasure in hearing that they reached Captain Evans, because having been partially instrumental in procuring them, I have always felt an interest in them, and if Dr. Campanena, the Director of Telegraphs in Brazil, reads the account of this meeting, he will be glad to hear as a fact that the bamboos which he took so much trouble to send to South Africa were really used. Bamboos no doubt will be the telegraph poles of the future, but I do not quite agree with Colonel Hamilton that poles should be excluded from the mountain equipment. I think that poles cut in two, and thus in lengths short enough to be carried conveniently on pack animals, can be used. They have been successfully used. The means of attaching the two pieces together are various, and some of them have answered perfectly. As I am no great believer in the use of a cable on the ground, and I believe many will agree with me that it is a precarious means of communication, I think that the exclusion of poles from the mountain equipment is a mistake, if it is possible, and I believe it is, that poles in two pieces of about 6 feet or 7 feet in length can be carried and used. I do not think there is anything else to allude to, except that for many reasons I do not place very great trust in a covered and concealed conductor lying on the ground. I do not quite agree with Colonel Hamilton's recommendation that the cable sections should precede the poles and air-lines when an army is sent to commence operations. As he properly observed, the applications of the telegraph to an army in a field vary with the circumstances of the country and other conditions, therefore, his examples are most useful as giving an indication of the various ways in which these sections can be applied, but still in no case would I send in advance only cable sections. I think there ought always to be in each section a mixture of both kinds of means of communication.

Captain BENNET, R.E.: I should like to ask one question with respect to the prospective organization of the Field Telegraph Corps, that is, whether it would not be worth while to consider the advisability of making the unit complete in itself as far as possible? We have been told that the unit is the section consisting of *either* 20 miles of cable *or* 20 miles of air-line, but it seems to me neither is complete in itself. Each serves entirely different purposes. For permanent or semi-permanent work the cable has dropped into disuse except in mountainous country where a special equipment altogether is required. The cable is now only required temporarily (for a few hours that is), while the last 2 or 3 miles of an aerial line is being constructed after a day's march, to be removed as soon as that is accomplished, or for lateral communications between brigades at night (the practical value of which I think is over-rated, and the practicability of which I venture to question except under unusually favourable circumstances), and in certain exceptional cases when telegraphic communication may be required for short distances at the shortest possible notice. For these reasons it seems to me to be well worthy of consideration whether the real working telegraph unit should not consist of the present air-line section *plus* one cable wagon and an extra G.S. wagon, carrying a total length of 25 miles. Each section would then be complete in itself, and with its reserve supply at the base would erect and maintain 80 miles of air-line, and 20 miles of cable.

Captain R. H. JELF, R.E.: Sir Andrew, there is one point that I think the meeting perhaps is not fully aware of from the able lecture we have heard, but as I happen at the present time to have the good fortune to be in command of the Telegraph Troop, I may call attention to it. I think anybody listening to the lecture would think that a mountain equipment was certainly part of our present equipment, and that it was in working order. I hope it is no indiscretion on my part to say that, though we all think it a most important branch, we have not yet had the slightest opportunity of even knowing what that equipment is to consist of. I have to-day gone round the stores at Woolwich, where I saw certain arrangements

which I suppose were intended to carry reels of wire on horses' backs, but certainly that is the first time I have ever seen anything at all fixed or settled as to what is to be the future organization for mountain work. Having been one of the earliest Officers in the troop, and having been in command of a half troop in the 1872 manœuvres, I beg to say that I also have the very strongest feeling as to the uncertainty of the cable for any continuous work. It is of course occasionally better than nothing. I have not been long enough in the troop since I came back from abroad to say whether great strides have been made in the use and material of the cable, but if the uncertainties of its working at the present day are anything like those of the cable of 1872, I think General Officers would find themselves very much better without it. There are two points that I may be allowed to mention. The lecturer referred to the rapidity with which the air-line could be laid. I am sorry to say from my experience of air-line, which is at present very limited, that certainly you never can count in any country upon laying air-line faster than 1 mile an hour. I think 2 miles an hour is 100 per cent. too good. That being so we cannot advance as fast as an army can march. Until we can arrive at that, or at all events are able to lay out some wire as fast as an army can march, I suppose we shall have to continue the use of the cable. But I hope the time will come when by the extra rapidity in the working of the air-line, and also by another method to which I am about to allude, we shall be able to keep up with an advancing column. I refer to the use of an instrument that has been devised, I believe, by Captain Cardew, R.E., the "Vibrator," or as we call it in the troop, the "Buzzer," which is found, in connection with the telephone, to be so wonderfully delicate, and sensitive, and unaffected by faults on the line, that I believe the time will come when we shall be able to lay the air-line along the road, and by means of the Buzzer be able to keep up communication with the advancing column before the poles are erected at all. The lecturer referred to certain difficulties connected with the Vibrator; I am not aware to what he alludes, but the only failure I have heard of at present is the difficulty arising when there are more lines than one alongside of one another, from induction tending to disturb the messages sent on one's own wire and on those of others. I am unaware of any other disadvantages. Effort is now being made to try this instrument in South Africa, and also in India, where there are long lines of single wire, and I hope that the result will be that we shall find that communication can be kept up through very long distances, and in most faulty times by its means. The only other point I think is one which was mentioned to me by another Officer to-day. It is the difficulty we shall probably have with our single wire in all future campaigns, with the enormous amount of private work that will be thrown upon it. The lecturer mentioned the immense amount of paper that has to be taken, and very sorry as one might be to interfere with private messages and so on, yet I think that in anything like a large campaign we shall have to keep our wire for the services of the Army. Until further wires can be laid it will not be practicable in my opinion with a large army to receive communications from private people. This may seem a small matter, but I think it is one that will have to be considered when we go further into the subject.

Major W. S. S. BISSET, R.E.: There is one point in which Colonel Hamilton has mentioned difficulties, namely, in the carriage of long poles for the purpose of erecting telegraph wires. I speak with much diffidence upon this subject, because telegraph construction has not been in my line at all, but I think it right on this occasion to mention that when the telegraph wire was being erected to Kandahar the telegraph Officers had in view the same difficulty that Colonel Hamilton now mentions. Fortunately, however, Lieutenant-Colonel Sir Oliver St. John, R.E., who had had much experience in erecting telegraph lines in Persia, was able to give them the benefit of his own experience in Persia, where, in a wild country with no carriage but camels and mules, he had distributed heavy posts of the longest length in use for ordinary telegraph lines. With this information before them, the Officers who had charge of the telegraph construction used poles varying from 15 feet to 18 feet in length. These, I may say, were not only bamboos, for bamboos were used only at the Indian end of the line; they were stout willow and poplar poles, such as at first sight it seemed impossible to carry on mules. But, as suggested by Sir Oliver St. John, these poles were slung over the mules' backs and carried with their

ends trailing on the ground, and were thus without difficulty distributed over 75 miles of line. This is a small matter, but it seems desirable to mention it, because Officers may not realize how easy it is to carry poles in that fashion.

Major ARMSTRONG, R.E.: I was very glad to hear the Officer now in command of the Field Telegraph Troop say he believes that ultimately we shall be able to advance a field telegraph as rapidly as an army can march. Such was the view of some Officers when that instrument to which Colonel Hamilton has alluded, was first proposed for introduction into the Service by Captain Cardew, R.E., some years ago. We all know how the fate of the Austrian Empire was determined by an engagement in which they were defeated by an accurately-timed combined attack of two armies moving independently at a great distance from each other, a feat which could be performed only with the greatest difficulty and uncertainty without some such telegraphic arrangement. So far as I can see there is no real difficulty in the matter. As Captain Jelf says, one could easily lay your bare wire along the ground as rapidly as the army marched, communications being maintained through the bare wire as the army advanced. The pole party should follow and put up the same wire on light poles, and other men could follow with poles and put the same wire up. Of course there are some self-evident objections, such as that a bare thin wire laid on the ground would be liable to be broken by traffic and other things, but it seems to me that these difficulties will not really be so serious when the system has been tried, which it never has been yet.

Lieutenant BOND, R.E.: I should like to say a few words about the working of the cable. I think that the cable is hardly appreciated as it should be. Under the orders of Colonel Hamilton I laid 12 miles of a cable in South Africa at the beginning of June, 1879, and for more than three months it was lying on the ground between Dundee and Landman's Drift, and though, owing to grass-fires, it gave a great deal of trouble, yet the trouble and cost of keeping it up was nothing compared with that of the air-lines in the same part of the country, which were subjected to the ravages of storms and herds of cattle as well. There is one other point that I should like to speak of, viz., the bare line lying on the ground. In South Africa when very hard up for materials on one occasion we had to place the wire on the ground for several miles between Koppie Allein and Itelezi, and work with Bell telephones and ordinary troop-pattern sounders, and for three weeks it was lying on the ground, and successfully worked during the day, when the ground was dry and hard.¹

Captain EVANS: As my name has been alluded to I will make two remarks; one is in relation to the poles. It may be considered a small matter, but I think it is rather an important one. Having had to keep up the line some time after it was left, I had to study the poles most carefully. Colonel Hamilton has said that bamboos will be the poles of the future. I suppose they will be, but I do not think bamboos are perfect. The bamboos from the Emperor of Brazil reached me, and I was very glad indeed to get them; they were much better than I had been working with before. Still I think the subject of poles is not settled. The bamboos are very good at first, but in a dry country with the heat of the sun they warp on one side, and get a graceful curve, and then the long swing of the curved pole cuts the wire almost more quickly than does an ordinary shaky pole. The only other remark I venture to make on the subject is on the subject of command. Having been at first in charge of signallers and not of the telegraph, and latterly in charge of the telegraph with no connection with the signallers, and as I am an Officer of a fusilier regiment, and can have no bias towards the Royal Engineers, in connection with the different branches of the Service, I cannot but say that I think the

¹ The cable was of great use in the late Egyptian Campaign, where it was employed for its more legitimate purpose, namely, short temporary lines between headquarters of brigades and divisions. It was also used in the reconnaissance from Kassassin on the 8th September, when 2½ miles were paid out as the troops advanced across the Wady. An office was established at the end, and communication at once established, and messages sent between General Graham and the camp; the line being reeled up afterwards, with the exception of half a mile, which was lost owing to the rapid advance of the enemy.—F. G. B.

command of the telegraph and of the signallers should vest in one and the same person. When I was in the Transvaal in charge of the telegraph I had no signalling apparatus at all. Breaks occurred on the wire line and the cable, and if I had had the signalling under my orders I should perhaps have been able to prevent break of communication. I think it a very important matter that all the means of sending messages should be in one and the same hand.

MR. VON FISCHER TREUENFELD: I have listened to the interesting paper and discussion with great attention, and believing that I am more or less acquainted with the organizations and working capacities of field telegraphs in European armies, I candidly confess that there is no Field Telegraph Troop more suitable for the work than that of the British Army. The English Field Telegraph soldiers—the men as well as the Officers—are not only soldiers, but they are trained and professional telegraphers. This is a difference which is very marked between the English telegraphers and those of other armies, where such men are very often civil servants taken from the Post Office. But with your kind permission I would venture to express an opinion, or rather an impression that I have; of course such impression can only be that of an outsider. There is a difference between the English and the German Field Telegraph organization, and it is rather a paradox to make a comparison between them, because the Germans have really no Field Telegraph troops. In case of an emergency the Field Telegraph service is brought together partly from the Post Office employés, the Engineer Officers, and Pioneer regiments, and partly from the military transport service. But in spite of this there is something in the German Field Telegraph organization which, in my opinion, is superior to that of the British, that is, the different way in which the two countries have organized. In Germany they began by creating a central office for all matters referring to field telegraphs, and put over this a Director of Field Telegraphs; they thus formed first the head, and left the body to future perfection. In England it is exactly the reverse with regard to this organization. Here we find an entirely efficient body of telegraph soldiers and Officers, but I do not think there exists what is wanted for a general direction, that is, a Director-General of Field Telegraphs. What has been the consequence of these differences of organization? Of course in the wars which Germany had, there was an immense deal of telegraph work promptly carried out, but it has always been at the rear of headquarters, because there was not, in my opinion, such a body of telegraphers and telegraph troops as could be trusted with the operations towards the front. With all the glorious battles that Germany has had there has not yet been a single battle fought where telegraph instruments have taken part in the tactical operations on the battle-field. Of course I except such cases as before Paris and Strasbourg, where the places were besieged. Otherwise the use of the telegraph on the battle-field is with the German Army still a matter of the future. On the other hand, in England, through the want of a Director-General of Field Telegraphs, who could keep constant connection with the general staff and all branches of field telegraphs, and direct the general dispositions at the outbreak of war, we find that there have been a good many drawbacks during all the wars that have taken place—from the Ashantee down to the latest Egyptian—drawbacks which can be traced to this special want. I only wish to point out this difference, and my opinion is that much greater perfection would be attained if the English Field Telegraph organization were so far extended that it not only possessed a strong body and limbs but also a head.

Colonel MALCOLM, R.E.: It has given me great pleasure to hear Baron von Treuenfeld say what he has said. Perhaps I may be allowed to remark that some twelve years ago—I think—I had the honour of submitting that there should be a Director of Telegraphs; and some few weeks ago I had to re-submit the question. I hope that with the support of an "outsider" like Baron von Treuenfeld we may some day get it.

Admiral GORE JONES: I should like, with the permission of the Chairman, to ask one simple question, but it is one that I think of very great importance. Several Officers have alluded to the bamboo poles. Some have spoken of their lightness, others of cutting them in two to make them stow better for carriage, but still the question has not been decided here as to what would be the best material for the poles. The chief reason given against the bamboo is that it warps from

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the effects of heat, and wags from the effects of wind, and one Officer who spoke seemed to think that these were very grave objections. But is there any material that will not warp under the effect of the sun, or not get deflected by the effect of strong winds? I want to know why bamboo, which unquestionably, on account of its lightness and toughness, is the best material that could be brought forward for this work, should not be stayed, because there is no wood that will not warp, and the bamboo has all the advantages of lightness and hard exterior. Therefore, I should like Officers who have had great experience in this to say whether all poles would not have more or less to be secured in such climates as produce very strong winds and a hot sun. I think this is rather an important point, and ought to be settled.

Captain H. P. LEACH, R.E. : I was in Afghanistan, but was not employed on telegraph work, so cannot give much information ; but I know that the telegraph company of the Bengal Sappers and Miners on the Khyber line always used bamboo poles. They were cut into lengths of about 7 feet ; two lengths fitted together formed one pole. They were carried on camels, and gave no bother in transport. The advance section of the company used the ground cable, which, however, was very often cut by the Afghans.

Admiral G. JONES : Did the poles ever warp ?

Captain LEACH : The line was not up more than five months, and they certainly did not warp during that time. Possibly the Indian bamboo is of superior quality to the Brazilian one. In India there are two classes of bamboo, the male and the female. The former is always used for telegraph poles when obtainable.

Lieutenant-Colonel HAMILTON, in reply, said : I have one or two remarks to make on questions which have been asked, and if you will allow me I will begin with the last one, and reply to Admiral Gore Jones. No doubt it is an advantage to all light lines where the poles are light, and have been selected on account of lightness, to stay them. But rapidity of construction is a very important point. Captain Jelf mentions that he does not feel he can calculate upon more than one mile per hour (and that is what I said might be calculated on), and if you are to stay every pole as you go along you would not get half a mile done in the hour. But when a line is kept up for a certain time, then it is the business of the party in charge of the line—and they actually do it on service—to go about and put stays wherever they see a pole leaning over, so as to give support to the right, or the left, or the front, or the rear. No doubt if a line is kept up for many months, as was the case with the line Captain Evans was speaking of, the poles will warp ; but there should be plenty of material for repairs, and enough men to look after it, and they would stay every pole that showed any tendency to warp. Colonel Webber mentioned that I said the submarine cable from Durban to Aden had been just laid, but I think I used the word “recently.” I did not mean not a year before, and he correctly pointed out that it had been laid a year before. As to Captain Bennet’s remarks, he has dealt with a great question that has been very much considered by those who had to do with this organization—whether they should mix up cable and air-line in a section. Foreign nations do it, but I think there are distinct advantages in keeping the cable to the front, because it can be easily put down and taken up. I said that 3 miles an hour can be done with cable, but I think on an emergency 5 or 6 miles of cable could be put down in that time and picked up just as fast, whereas the air-line work is slow. I think the artillery would just as soon make up a battery partly of 9-pounders and partly of 16-pounders as that we should put the cable and air-line together, especially as we propose for each section to have reserves of its own description of material, and so to lay not only 20 miles to a section, but 40, 60, 80, or 100 miles. That is the reason why I think it advantageous to keep the cable to itself, and the air-line to itself ; but I do not consider that any expedition would be complete without at least one section of each description. I am much obliged to Major Bisset for his information about the transport of the long poles. That, no doubt, is good when only long poles can be got, and when they are obtained locally, but in the organization in peace-time for war one naturally obtains the best sort of poles one can, and collects them in the arsenals so as to have them available, and such as he described were certainly not the best, but they were the most useful on the spot. Of course, we are very much obliged to Baron

von Fischer Treuenfeld for his remarks as to the organization. That was, however, a point a little beyond and higher than I felt myself justified in speaking of. I have, in fact, only described the actual technical and regimental organization of the field telegraph, and not that higher organization which proceeds from those in authority. I have no doubt whatever that it would be a most advantageous matter for our Army to have a Director of Military Telegraphs during peace, who should know exactly where every man and every single article of material were to be found, and what were the resources and requirements of different countries, so that the moment a campaign was decided on he would be able to set the whole in motion. I think when we get to that point that the name of every man of the first, of the second, of the third, and of the fourth section for active service should be registered, so that every man should know when his turn came, and what he had to do—the organization would thus be completed in peace so as to be ready for war. I have to thank you for your very kind attention.

The CHAIRMAN: In asking you to return thanks for the very interesting, valuable, and suggestive lecture that we have heard to-day, I should like to claim your attention for a minute or two. Major Bisset and Captain Leach have given some particulars with reference to the working of telegraphs in the two campaigns of 1879 and 1880, and I have received a note from Major King Harman, of the Bengal Staff Corps, who has asked me to read it to the meeting, with regard to his experience on the survey in Afghanistan: "Sir,—As the lecturer states himself unable to give any details of the very efficient work which was carried out in Afghanistan by the Royal Engineer Field Telegraphs, I hope that the few details that I can remember will be of interest. From the 25th of January up to the 10th of February, 1879, a ground line was laid and steadily worked between Dakka and Jellalabad, a distance of about 40 miles; it was then superseded by an aerial line, which worked perfectly up to the 10th of March, by which time the Government field line was in working order; so the Royal Engineer lines were taken down and pushed on with Divisional headquarters to Safed Sang, where they worked regularly until again replaced by the Government civil line in the first week of May. The Royal Engineer line also did great service on the Kanakar line before the civil lines could be got into working order. I have seen a great deal of the working of the Royal Engineer Telegraph Companies in Bengal, both on service and at camps of exercise, and I know them to be thoroughly efficient in every way, and perfectly ready to start at three hours' notice for active service in any part of the world. The lecturer also mentions the heliograph, which was known and used in India long before it was brought into use in England or elsewhere. I can only say that nothing could have been more perfect than the way in which it was worked throughout the Afghan War. Lieutenants Whistler, Smith, and Dickie, of the Royal Engineers, and Captains Stratton and Wynne, of the Infantry, were the chief organizers and workers, and it was owing to the skill, intelligence, and indefatigable exertions of those Officers, and of those working under them, that (with the sole exception of General Burrows' brigade at Maiwand) at all times our troops were always in constant communication with each other, and with Divisional headquarters." I think that note is an interesting one and throws some light upon it. Speaking of my own experience in this matter, the bamboos were almost exclusively used by the Civil Telegraph Department of India, in all their lines both on the Candahar, the Khourum Valley, and the Khyber Pass. That they were considered satisfactory may be concluded from the fact that after they were taken down at the close of the first epoch of the Afghan War, they were again sent for in larger numbers to the front and were used on the second occasion; this is, I think, the best evidence that we have that the Telegraph Department of India were entirely satisfied with the bamboo. It has been the subject of constant investigation by technical Committees that have sat in this country, and a good number of bamboos from various parts of the world have been tried. There is a bamboo called the Hong Kong bamboo, which has been adopted for the Service, and I fancy, as suggested by the gallant Admiral, that where the line becomes permanent the poles will be more or less stayed. For temporary purposes, of course, that would not be necessary. As one having some interest in this question, and some responsibility connected with it, I am exceedingly grateful and thankful for the

very valuable remarks that have been given to us by Herr von Treuenfeld, on the question of the administration of the Department. It is the more satisfactory to me because the organization he advocates runs in the lines that I am myself at this very moment advocating, and which I hope to see in a short time established. On the whole I am also gratified by the evidence that is offered us with reference to our departmental organization. Colonel Hamilton has shown clearly the successive steps by which the present organization for the telegraph service has been arrived at. Its present efficiency is no doubt due to the fact that we have not had to retrace our steps in any way, and have made constant progress since the creation of the Telegraph Troop in 1869. The great advantages derived from the employment of the Royal Engineers in the Postal Telegraphs have been recognized more and more as time has gone on, and steps have been continually taken to strengthen their connection with the Telegraph Troops. These steps have culminated in the present organizations by which the Telegraph Troop and Postal Telegraph Companies have become practically one body. We have thus incorporated into the Military Telegraph Service the experience and skill of the civil departments of the State. Each successive campaign has shown the wisdom of the measures introduced since the preceding one, and which have been obtained from the experiences derived in that campaign. It is only by a searching investigation and careful criticism on the work after the conclusion of a war that the various shortcomings can be ascertained. I may say that the present organization has proved efficient in the Transvaal and Egyptian Campaigns, although the want of a direct head, a single Director of Telegraphs, was to a certain extent felt in the latter war. A Committee consisting of Officers of great experience both in peace and war have recently prepared a report suggesting further improvements which I hope in a very short time will have received the approval of the Government. There is only one other point that strikes me to which I would allude. Some little doubt has been thrown upon the value of the cable line. My own feeling with reference to it is this: if I had charge and responsibility in the field, my first care would be for the lines feeling the enemy in front of me than for the lines to England. Sometimes I should feel that if there was a check in my rear, and the messages did not come quite so quick from home, perhaps it would be better for those in front. What I hope my brother Officers engaged in military telegraphy will pay great attention to is the development of some very quick system of being able to carry out and carry to the front of an army, and to the outposts, a ready system of telegraphing. The delay of half an hour or ten minutes in communicating information to the General commanding might be of great importance. The man who just feels and knows where his enemy is has a great pull over his opponent, and it is in reference to that that we must adhere to a cable system, although perhaps our present system may be much improved upon. There was certainly a very important point which Colonel Hamilton brought out, to which I attach very great value, and which has a bearing also on the remark I have just made; that is, the absolute necessity at the very moment that our troops touch other soil that means for telegraphic communication should at once be begun. It does not do now-a-days to throw your troops on shore and then launch them into the interior, with no means of communication with your base. There was no doubt rather an oversight on the last occasion in the delays that took place in not having our telegraphic machinery in working order as soon as it ought to be, owing to the fact that it was not sufficiently recognized that the telegraph companies and those on the lines of communication should be put on board the fastest steamers and the fastest vessels. I have to thank you for the attention you have paid to the speaker. It only becomes my duty now to ask you to accord to the lecturer your thanks for this very interesting paper.

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Friday, February 22, 1884.

ADMIRAL R. STOPFORD, in the Chair.

THE RAM—THE PROMINENT FEATURE OF FUTURE NAVAL VICTORIES.

By Admiral Sir GEORGE ELLIOT, K.C.B.

IN undertaking, at the request of the Committee of the Royal United Service Institution, to prepare a paper for this year's discussions on naval matters, I have selected the above title because I consider that, although very able essays have been written on "The Gun and Ram and Torpedo," the subject has not been sufficiently dealt with on its merits, and that on certain points which should dominate the construction of fleet ships, the essayists had felt a difficulty in giving full force to their opinions. The inference I have drawn from what has been left undefined, and from what has been elaborated by essayists on what concerns fleet actions at sea, is that they have felt constrained to regulate their opinions by the types of armour-clads which prevail, and that they have therefore not given sufficient importance to the ram-bow in the construction of fleet ships.

It is evident that hitherto the greatest prominence has been given to gun attack and defence by naval authorities of all nations; this probably accounts for the limited extent to which the fortifying of bows for ramming has been carried out, and affords the probable explanation for the caution with which the question of end-on ramming, or bow-to-bow attack, has been approached by naval essayists. It may also have given rise to such evolutions as I have seen proposed by tacticians, where two fleets meeting end-on have both been of the same mind to pass through their respective lines (in fact, funking the bow-to-bow encounter), and have then been supposed rapidly to turn about and repeat the same tactics. The numerous diagrams on naval tactics and the volume of evolutionary signals have also tended to create the same impression, that fleet battles will principally be decided by the gun and torpedo, which impression is confirmed by the inadequate strength and protection which is bestowed on the ram-bows of our armour-clads.

I find that Captains Colomb, Noel, Pellew, and Dawson, and the French writer, Admiral Touchard, have all given full expression to the prominent part which the ram should play in fleet battles,

and I have no doubt that all naval Officers would advance the same opinions, but the probability which appears to be assumed is that this mode of attack will be limited to the endeavour to strike on the broadside, and that the meeting bow to bow will as a rule be avoided, because of the danger of self-destruction; this brings me to the object of my paper, which is to endeavour to show that bow-to-bow ramming will be the rule, and not the exception, in fleet actions, because the strongest-bowed ships will force that mode of encounter, from which no manœuvring can afford a means of escape. I am now dealing solely with the question of fleet actions, as I will refer to single actions hereafter, and I will proceed to exemplify the case to the best of my ability.

I will take two hostile fleets of equal numerical force, every ship having the same displacement, the same speed and gun-power, Fleet A having her main structural strength in the bows as well as a powerful end-on gun-fire; Fleet B is weaker in these respects, but more powerful on her broadside by just so much weight of guns and armour as has been spared from that which Fleet A has placed at the bows.

These fleets are steaming towards each other in such formation as the respective chiefs have decided upon, and thus they approach end-on. Fleet A, confident in their superior bow-strength, mean ramming at all hazards, bow to bow if necessary. My opinion is that Fleet B must turn tail at some distance off or hazard the encounter of the intended bow-to-bow attack, in which case Fleet A must be victorious in the end.

It will, I dare say, be said that even the stronger-bowed ships will not get off with impunity: that, as Captain Noel says, "the shock between two heavy ships meeting in opposite directions would be so terrible that engines might be damaged, if not disabled, and boilers might be displaced, if not specially stayed." It is true that on this point none can speak from experience, but it is most unlikely that in such circumstances ships will be meeting at full speed, and the stronger-bowed ship will run the least risk of fatal disaster, especially if she is the handier vessel.

I will now describe the mode of strengthening the bow which might be adopted without adding greater weight to the extreme end than can be carried with safety. The water-line belt should be carried forward to the stem, an armour-plated deck should support the belt at its upper and lower extremity, the round of the bow should be armour-plated well down and well aft, and the fore part of the ship should be divided into numerous compartments, filled with cork. Considering that the "Téméraire's" fore turret and armour weighs 600 tons and is close forward, the structural weight I propose would not be unexampled.

The French naval authorities have dealt with this question of strength of bow more than ours have done, and their ships would therefore be more inclined to ram bow to bow; but the Italian monster armour-clads are very vulnerable indeed at the bows.

In order to exemplify still further, I will quote some remarks from

a clever little pamphlet, which lately appeared, called "The Battle of Port Said." This ideal battle, like the Battle of Dorking, is intended, I presume, to be in part truly representative, and partly critical, and partly burlesque; at any rate, there is much that is useful in the narrative for thoughtful readers, and the incidents would have been more instructive if the author had not fallen into the error of most writers on tactics, namely, that of not giving his opponent the credit of altering his formation to the best advantage according to that in which his enemy is approaching.

For instance, the English Fleet is made to adopt what in my opinion is probably the best formation under all circumstances, namely, the group formation with leaders in line abreast, the position of the ships in each group being also well chosen. Then the author decides for the enemy that he will meet this mode of attack by placing his fleet in two columns in line abreast, probably the weakest formation which could be selected unless it were intended as a blind with the intention of altering it by one timely manœuvre before joining in combat. However, I refer to this pamphlet because the author gives admirable reasons for the formation selected for the English Fleet, one of which I desire to quote, namely, "the ram is a most powerful weapon, and vessels would have a better chance of using their rams in this formation than on any other."

Now after this I expected to find some expert ramming in this ideal encounter, but with one exception, that of an English ship ramming a French ship on the broadside, these two fleets are supposed to have passed through each other without any favourable occasion for ramming having presented itself. The writer describes himself as having been placed at the director with orders to fire the broadside by electricity as soon as the director sights were on the main mast of the French flag-ship on which they were bearing down, the guns having previously been laid horizontal 15 degrees before the beam. He then says, "I could see through the small port of the conning tower the black nose of the 'Admiral Duperré' close on our starboard bow," and then that he fired his broadside at 50 yards off on the main mast coming into line with his sights.

Now on reading this ideal incident of the two flag-ships approaching each other on directly opposite courses, and suddenly sighting each other through the smoke at two points on their respective bows at 50 yards distance, and then passing on to exchange broadsides without any attempt at ramming, I was struck with the improbability of the idea, because the opportunity thus presented of striking a deadly blow was so advantageous to that ship which made the first movement towards the other by suddenly putting her helm hard over; no doubt the movement would have been perceived, and a similar action of the helm taken, but the gain of a few minutes would have greatly favoured the attacking ram, more especially in the case of a handier ship. Besides it is only natural to conclude that the strong-bowed and handier ship would not have waited to bring her adversary two points on her bow before altering the helm.

Now as this is probably the most complete view yet afforded of an

ideal fleet battle of the present day, I would ask whether all the formidable anticipations of what rams could and would do in an actual fight are not completely lost sight of. The prevailing idea appears to be that fleet ships will funk end-on ramming because it may prove self-destructive, and that in a *mêlée* they will funk the attempt at broadside ramming because they may expose themselves to be rammed by some other ship, and therefore that passing through the lines of battle will be the order of the day, and the gun and torpedo will be the most important weapons of offence.

I presume to differ entirely with what appears to be the prevailing opinion on what may be expected to occur in fleet actions. I believe that unless hostile fleets approach each other in very open order, a most unlikely case, fleet actions will from the first become a *mêlée*, and that bow-to-bow ramming will be the ruling feature of the fights, because ships will naturally turn towards each other from self-defence, as turning away will expose their sterns. Funking will be of no avail, because the strongest-bowed ships will compel their opponents to meet them end-on, and these bow-to-bow encounters will be as skilfully fought as duels with the sword, each Captain watching his approaching foe as a cat does a mouse, and striving by skilful steering to bring his stem to strike at an angle of inclination towards his opponent's bow. Short ships with great steering power will prove the most dangerous in this fencing for a weak spot, and a good nerve and a quick eye will be greatly needed. Those ships which escape from a bow-to-bow encounter will, whilst passing onwards, look out in every direction for a chance of ramming, and if the fleets are in anything like close order, I reckon that rams and not guns will decide the fight.

If my judgment be correct, what lesson does it teach our naval designers? Does it not point to the fallacy of large unwieldy ships with weak bows such as the Italians have been building? Does it not recommend a larger number of smaller vessels with great steering power, although not so powerfully armed? Would not a fleet of sixteen of such fleet ships of 8,000 tons displacement be more than a match for twelve fleet ships of 12,000 tons displacement? I very much question whether an equal number of the smaller and handier vessels would not have the best of it in a fleet action. I know that I may be told that the Italians in such a case would, with their greater speed, separate and fight at long balls, thus avoiding the ram and torpedo attack, but I cannot perceive that any practical advantages would result from this mode of fighting, seeing that the smaller vessels, by turning their armour-plated bows to the enemy, would present a smaller target, and that shots reaching their aim would be deflected.

However, as monster fleet ships are being built with a view to obtaining greater speed as well as stouter armour, and as this acquirement entails loss of handiness, it is desirable that this subject should be carefully considered in all its bearings on fleet actions.

I maintain that the fighting advantages will belong to ships of moderate size and speed, and with great strength and protection of the ram-bow, even if carrying only one armour-piercing gun instead

of two, as the single-barrelled turret would admit of much stouter armour protection, a most important consideration in close action.

In 1871, as members of the Committee on Designs for Ships-of-War, Admiral Ryder and I dissented from the opinion of our colleagues mainly on the question of central citadels and revolving turrets and unprotected ends, and we strongly urged their abandonment, and we recommended barbette towers and a stout submerged armour deck fore and aft to protect the vitals with a cellular water-line protection and coffer-dam sides, and armour-plated bows and with powerful end-on fire, and I have seen no reason to vary those opinions; having always considered that the choice between an all-round armour-plated water-line belt and a cellular water-line efficiently developed, was a question which the progress of artillery power must eventually decide in favour of the latter. Steel plating has protracted the life of the belt of armour, but if my theory of smaller fleet ships and more of them be a correct one, and if 18 inches of compound armour affords no protection against the direct impact of the 80-ton B.L. gun, the merits of a cellular water-line must soon be recognized, the most important feature of which is, the submerged stout armour-plated deck protecting the vitals.

I am quite aware that the partial protection which is all that is now claimed for armour-plating preserves its attractions, but I would invite my brother Officers to consider this question solely in relation to vital consequences, that is to say, fighting endurance, and in this light I maintain that the cellular water-line protection affords greater security to the prolonged life of a ship.

The respective merits of a penetrable belt of armour round the water-line, and a raft body with coffer-dam sides built upon a submerged armour-plated deck, have never been discussed at this Institution, although I am aware that the Construction Department have considered the question. We have arrived at 20 inches of armour, and ships of 12,000 tons displacement. Is the 100-ton breech-loader the limit of the power of the gun which can be mounted? If we can mount two of such guns in a turret, why not one 200-pr.? To say nothing of improved gun power which may be forthcoming. If my theory of a limited size of fleet ships be right, then the thickness of armour must also be limited, and being penetrable, the alternative of a cellular water-line will probably receive at last its due consideration.

Another feature which enters largely into the question of rams *versus* guns in fleet actions is that of smoke. Two fleets advancing end-on, it may reasonably be expected that the bow guns will not have been idle, and that the smoke thereby occasioned will complicate matters extremely, but under all circumstances the greater facilities for dealing vital blows will belong to the shortest and handiest ships, and intelligence from aloft will be a most useful auxiliary. The effect of smoke added to rolling motion will greatly limit the accuracy of the gun attack, and broadside fire if it misses its aim may reach a friend instead of a foe. It is most important that some decided opinion should be arrived at as to whether the ram or the

gun should dominate construction, as on this depends the question of size of ship and guns and distribution of guns and armour; but I hold to the opinion that every fleet ship should mount at least two of the most powerful guns that can be produced, and in single-barrelled turrets, besides a heavy bow battery and some lighter broad-side guns on the deck below.

I must repeat that in what I have written I have referred solely to fleet actions and to the fleet ship proper, and I will now refer to single actions. I have always held the opinion lately expressed by Captain Harris in his most admirable paper read at this Institution in April last, that there should be two classes of sea-going armour-clads, the one faster than the other.¹ I make the distinction broader than he does to mark the respective services required to be performed. In a paper which I read at the Institution of Naval Architects in April, 1867, on the classification of ships-of-war, I elucidated my views on this subject by a table showing the qualifications for each class of war-ships in their numerical order of importance, and if this plan were adopted by the Naval Lords of the Admiralty, the assistance thus rendered to the Constructors would lead to greater uniformity and efficiency, and tend to establish responsibility. As a seaman, I can see the most cogent reasons why the fleet of England should consist of two distinct classes of armour-clads; the first, Class A, for foreign service, and the second, Class B, for European waters, each fleet of the latter to be accompanied by a small force of the former. Class A to have a displacement of 10,000 tons, and a sea-going speed of at least 16 knots; and class B a displacement of 8,000 tons, and a sea-going speed of 12 knots, these conditions being in my opinion the most conducive to the efficient performance of the respective duties to be carried out. The same reason which rendered it essential to limit the displacement of Class B, namely, to obtain handiness in fleet actions, does not apply to Class A, and the reason which renders great speed essential for Class A does not apply to Class B. Ships of the A class could, when attached to a fleet, attack the sternmost ships of an enemy striving to escape, and thus bring on an action, or would form a reserve squadron in a battle between two fleets. In other respects these two classes would differ in their essential requirements, and these distinctive qualifications can best be defined in a table in their numerical order of importance as follows:—

Class A.

1. Sea-going.
2. Speed under steam.
3. Guns and armour.
4. Stowage.
5. Sailing power.
6. Handiness.
7. Light draught.

Class B.

1. Sea-going.
2. Handiness.
3. Guns and armour.
4. Speed under steam.
5. Stowage.
6. Sail-power.
7. Light draught.

I place sea-going first in both classes because it is due to the crews

¹ *Vide Journal*, vol. xxvii, page 412, *et seq.*

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Class A.	Class B.
1. Sea-going.	1. Sea-going.
2. Speed under steam.	2. Handiness.
3. Guns and armour.	3. Guns and armour.
4. Stowage.	4. Speed under steam.
5. Sailing power.	5. Stowage.
6. Handiness.	6. Sail-power.
7. Light draught.	7. Light draught.

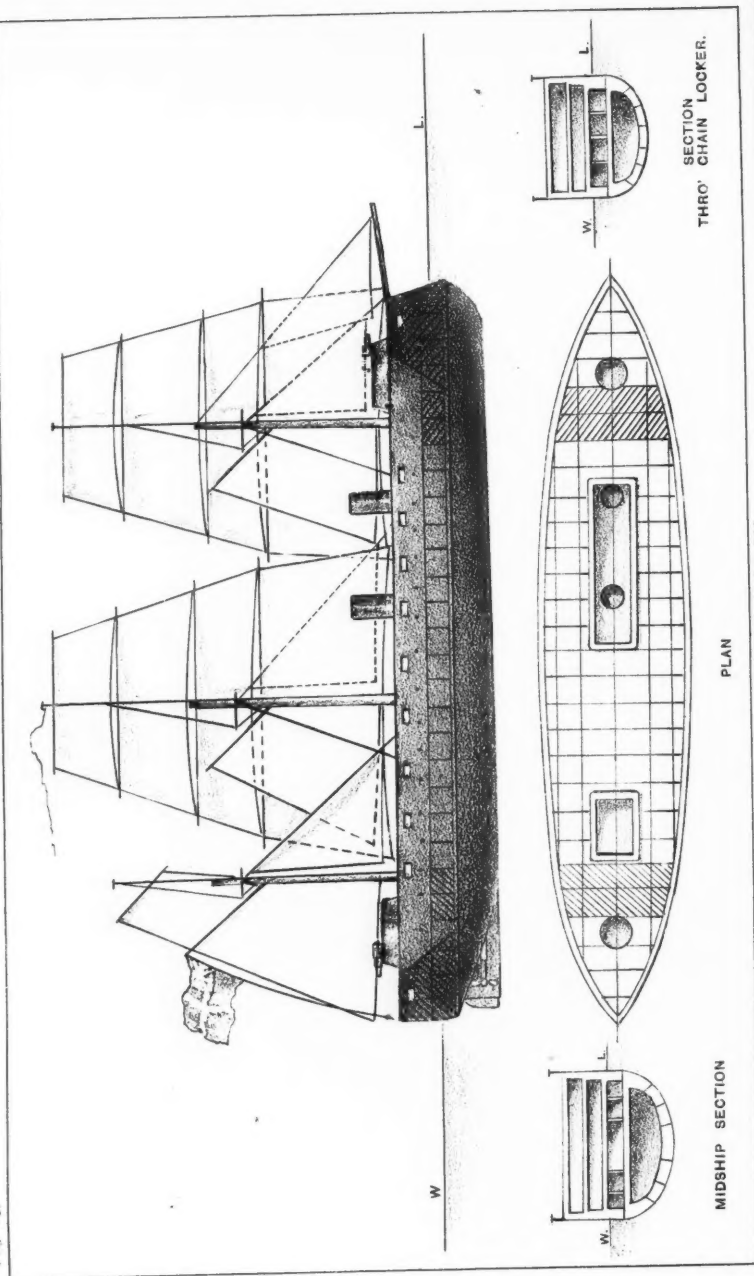
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¹ *Vide Journal*, vol. xxvii, page 412, *et seq.*

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that no liberties should be taken which might imperil the safety of Her Majesty's ships in the storms to be encountered on the wide ocean.

It will be seen by the drawing (Plate VIII) that above the raft body is the lower deck for habitation for the crew, being high enough out of water to admit of good sized scuttle ports—above that is the main deck, with a battery of light guns and heavier bow and stern guns, and above that the barbette turrets.

It is quite admissible that these two classes should carry the same number of guns, and the same thickness of armour, and that Class A should possess greater speed and sail-power, and stowage of fuel and provisions and stores, but much less handiness than Class B, whilst the latter would greatly excel in that respect.

The battles of Class A would chiefly be fought single-handed or acting independently of the order of battle in fleet actions, and in these contests the gun attack would be the prominent feature of fighting, therefore this class might carry double-barrelled turrets. All turrets should be protected from vertical machine-gun fire by a raised covering deck.

The attempt to combine all these requirements in one class of armour-clads must result in having excelled in none.

I have explained why I consider that strength of bow and handiness will be the most prominent features of future naval victories in fleet actions, and although the opportunities for ramming in single actions will rarely be found, yet the importance of an armour-plated bow and powerful end-on fire must not be lost sight of in considering the tactics which would prove most advantageous in an encounter at sea between two armour-clads possessing equal speed and displacement and weight of guns and armour.

I raised this question once before at this Institution, but it led to little or no discussion, and I will, therefore, take this opportunity of reverting to the subject by representing an imaginary sea-fight between single ships with armour differently distributed.

Ships X and Y are two armour-clads, of equal speed, meeting at sea and intending to fight. They steam towards each other, Ship X having a bow well strengthened for ramming and powerful end-on fire. Ship Y has a more powerful broadside fire, but is weaker at the bow. Ship X has reason to know the type of ship built by the enemy, and he sees his advantage: he is determined to meet his adversary bow to bow if he will only come on. He steers right for him and Ship Y must turn away in good time if he desires to avoid that kind of encounter. Ship X still steers right for him wherever he goes. He thus presents a small target and his bow armour-plating deflects the shot, and each attempt of the enemy to bring his broadside guns to bear only shortens the intervening distance, and eventually he must turn tail and fight stern on against X's better protected bow, and I presume it will be allowed that the stern being more vulnerable than the bow, X must have the best of the fight, and this would be still more conspicuous if Y had unprotected ends like the Italian armour-clads.

I have thus described the advantage of the most powerful bow in single action, but of course, if all ships were equally strengthened at the bows and equally handy, then the bow-to-bow encounter would be the exception to the rule and other tactics would be pursued. Most French ships have armour-plated bows, but the Italians are badly off in that respect and are also unhandy, owing to their great size, and consequently will invite the ram attack.

The sail-power of the two classes of armour-clads I have described in my table deserves something more than a passing remark, and I take this opportunity of expressing my admiration of the skilful treatment of this subject by Captain G. H. Noel, which, to my mind, reflects the broad principles of sound practical seamanship.¹ I feel strongly convinced that no steamer can be considered safe at sea without having the means of spreading such an amount of strong canvas (by which I mean square canvas) as will, in the event of her engines breaking down (not at all an uncommon occurrence), act as a steadiment in boisterous seas, and enable her, if needs be, to turn her head off shore, and there are few trading companies venturesome enough to despise this measure of precaution.

With regard to the amount of sail-power, no hard and fast line can be applied to the whole fleet, such as a relative proportion of area of canvas compared to displacement. The area of canvas to be carried by each class of war-ship must be regulated by the nature of the employment for which they have been designed. I quite agree with Captains Colomb and Noel that great improvement is needed in the system of masting ships in the Royal Navy, and that the best rig will be that which presents the least resistance to the wind when steaming, and which admits of the top hamper being got down most readily, and which can be worked by the smallest number of trained seamen; and yet these conditions must be so carried out in the case of each class as to admit of the spread of a given amount of canvas. My idea of the best rig for all fighting-ships is as follows:—

(1.) Short masts and square yards, the length proportioned to the area of square sail to be carried (why not tripod masts?).

(2.) Long lower mastheads, on which to set a close-reefed cap-topsail.

(3.) A topmast and top-gallant mast in one, on which to set an upper topsail and top-gallant sail of lighter canvas.

(4.) No royals or studding-sails, but try-sails and stay-sails wherever they can be set to advantage.

(5.) No bowsprit, but a jib-boom to run in.

Class A, as a cruising ship, would require a much larger spread of canvas proportionately to displacement than Class B.

This rig would admit of the topmast and upper yards being got down quickly at all times and without much labour, and the cap-topsail of strong canvas is to my mind a most valuable feature of equipment for fleet ships in these days when the crews are so short-handed, especially as regards trained seamen. The gradual diminution of the number of the seaman class in the crews of armour-

¹ *Fide* Journal, vol. xxvii, page 543, *et seq.*

clads is, even in peace-time, a great misfortune. If more men were required for engineering purposes, they should have supplemented the ordinary fighting element in the crew, and not reduced it, and in the designs for ships-of-war the extra accommodation which will be required for an increased crew for war purposes has apparently been lost sight of. Every war-ship should be a training-ship for young seamen, so as to supply the reserve fleet on the outbreak of war (should there be one) with a nucleus of active topmen, which the naval reserves of seamen could not provide. I was glad to read Lord Alcester's views on the value of active topmen; but there is another striking feature connected with the number of fighting men in the crews of our armour-clads, which is that, unless greatly increased on the outbreak of war, how are the wounded men to be replaced? and if increased, where is the accommodation?

Since the introduction of such destructive weapons of offence, it must be expected that disablement of fighting men will be rapid and extensive, and unless the guns' crews can be replaced, the guns must remain silent; and reduced crews of seamen even in peace-time is not economy in the long run. My enthusiasm on this point has, however, rather diverted my pen from the subject of my paper, but I propose now to offer a few supplementary remarks on one or two subjects which I have previously introduced. I have no doubt that objections will be raised to the preference I have given to single-barrelled turrets for ships of Class B, which ships will form the fighting fleet, and that complaint will be made of the loss of gun-power, but I argue that the saving of weight thus obtained can be more usefully bestowed on affording increased protection. The larger the turret the greater the exposure of the crews to machine-gun fire, and it is evidently essential that some efficient protection against overhead machine-gun fire should be given to the crews in these open turrets, as close quarters will be inevitable in fleet actions.

I saw the effect of rifle-fire on the open port of a tower at Bomarsund, which almost completely silenced the gun, and what with smoke and machine-guns I think the accuracy of gun-fire in fleet actions will be greatly interfered with, added to the risk of the shots reaching a friendly ship, not seen to be in the line of fire.

I do not despise gun-power—quite the contrary—but the opportunities for accurate aim after an action has commenced will, to say nothing of the rolling motion, be few and far between, and if ships are protected at the water-line by a submerged armour deck and cellular body, I am of opinion that gun-fire will prove less deadly in its results, and therefore less conducive to victory than the ram or torpedo. If this be conceded, why should the gun-power be looked upon as of the first importance, as is apparent in all armour-clad ships? In single action the power of the gun will doubtless predominate, and therefore in Class A the double-barrelled turret might be preferred.

The Battle of Lissa was not won by the gun, but by the ram, and that was in the days of wooden ships and comparatively weak bows.

I will now offer an opinion about the spur in relation to ramming.

The object of this protuberance is plainly seen to be that of entering a ship below the armour-belt, but in many cases it may counteract its own intention, as it is obstructive to handiness, and a slight advantage obtained in the direction of the bow may be found far more important in its effects than merely perforating a hole under water; the less there is of cutwater and keel the better for handiness.

If a ram blow is struck at all fair it will most probably crush in the side at the water-line, and it is immaterial whether the inlet of water into a large compartment is a little lower or a little higher. I dare say I shall be told of the tearing effects of the spur when in contact with under-water plating, but the projection of the round of the bow will generally keep the spur out of contact, which can easily be seen by placing two models of ships together at different angles of inclination. Altogether it is a question to my mind whether the hindrance to quick turning does not overrule the possible advantage of a spur in ramming.

I would now trespass on your patience for a little longer, whilst I give a few details on the advantages offered by substituting a cellular water-line protection, with a submerged armour-plated deck, for the outside belt of armour hitherto relied upon as a defence both against the gun and the ram attack. If my theory about the superior fighting qualities of fleet ships, of moderate proportions, when strengthened for ramming, be correct as regards fleet actions, and if it follows that the thickness of side armour is limited to the size of ship, then the merits of the alternative mode of protection become more prominent.¹

As far back as 1856, in the earliest days of armour-plating, Sir William Armstrong and Sir Joseph Whitworth, in their evidence before the Royal Commission on National Defences, foretold as a matter of certainty that the possible gun of the future must destroy the possible armour any ship could carry, unless of inordinate, and therefore objectionable, dimensions. In 1871 I did my utmost to persuade my colleagues on the Committee on Designs for Ships-of-War to the same effect, but in vain. Obsolete ship-building has continued up to this day, and is still contemplated with apparent satisfaction, notwithstanding that the 80-ton breech-loading gun has latterly penetrated and smashed up 18 inches of compound armour, and that a gun of 150 tons weight is soon to appear on the scene.¹ Have we not yet arrived at a crisis in the theory of fighting-vitality dependent upon outside armour-plating? I feel convinced that this craze cannot last much longer, and fortunate will be that naval Power which soonest wakes up to the peril thus engendered. I shall therefore endeavour to bring into prominent notice on this occasion the peculiar properties of the cellular water-line protection recommended by Admiral Ryder and myself as far back as 1871.

No arguments have yet come to my notice which have fully and impartially dealt with this important feature of construction: and, in fact, this question has never been submitted to the test of exhaustive inquiry and experiment, but has been summarily disposed of by naval critics, on the assumption that even partial protection afforded by an

¹ The belt armour of the "Impérieuse" class is only 8 or 10 inches thick.

armour-belt is better than that all missiles should penetrate even when fired from guns of the lightest calibre.

I own that this view of the question is at first sight attractive, but the charm disappears when it is considered in all its bearings upon fighting endurance and vitality—the object sought for in each case being to protect the vitals of a ship, that is, the magazines and boilers, and to prevent such a dangerous inlet of water as would totally disable or sink her.

The gravity of the question cannot be overrated. The destructive agencies have increased enormously; but is it not possible to prevent war-ships from being blown up or sunk by well-directed broadsides from guns which can be mounted at sea?

I maintain that this cannot be done by any outside armour a ship can carry, but that it can be securely effected by a submerged armour-plated deck, of sufficient thickness to deflect any possible missile from going below, and by a cellular or raft body built upon that deck, which, although considerably riddled, would not endanger her buoyancy, and which would admit of rapid repairs by various simple appliances. I would also observe that this stout armour-plated deck would offer much greater resistance to a ram blow than could be obtained by a vertical belt of armour unsupported from behind, as the whole ship above and below being fastened to this deck, the entire structure would supplement the resisting power of this horizontal cleaver. In fact, those who propose to abandon side armour do so because they consider that a far more reliable protection can be obtained by utilizing the same weight of armour-plating in a different manner, that is to say, where it can be effectually applied for deflecting projectiles in lieu of the vain endeavour to resist penetration.

A provision of safety from any dangerous inlet of water, even from the largest projectile, would be afforded by the coffer-dam sides and the numerous cells which would form the cellular body, extending from five or six feet below to the same distance above the water-line. No shell projectile from a rifled gun would burst until after passing through the side, and the aperture would therefore not be large; and by using cork bags with pressure from above in the coffer-dam the entry of water could be stopped, and various appliances would suggest themselves for repairing damages within the cells. All these cells and the coffer-dam should be open at the top, that is, merely with gratings over them so as to diminish the effect of shell explosion by freeing the course of gas upwards. I am prepared to be warned of the effect of shell explosion on board, and the effect of machine-gun fire and grape and canister, but such large proportions of existing armour-clads are unprotected that this objection can have little force, and it may well be asked in comparison what would be the result of an armour-plate being smashed in at the water-line?

Space will not admit of my entering more largely into details, but this raft body might be used for stowage of appropriate materials, such as water, coals, and provisions. And as a protection against raking fire, a portion of the raft body athwart ships at the fore and after end could be stowed with chain and hemp cables, cordage and

sails and seamen's bags, which would, in addition to the armoured-plated bow, in most cases offer a sufficient resistance.

One great advantage of the alternative plan which I have described is that fleet ships would be less costly and more quickly built, and that they would not be rendered obsolete by any probable increase of artillery power.

I have not referred to that most destructive weapon of offence, the torpedo, in fleet actions, because its operations are not affected by any suggestions contained in my paper; however, it must be obvious that handy ships will bring that weapon more readily into effect, and I conclude that all fleet ships will be fitted to discharge torpedoes from the bow as well as the broadside, and that the end-on presentation will always prove the least vulnerable to that mode of attack. Torpedo-boats will also in moderate weather tell their own tale, but as a matter of economic expenditure I question the advantage of constructing such ships as the "Polyphemus" in lieu of an equal expenditure on fleet ships.

I have no doubt that swift sea-going torpedo vessels will be introduced, but it must be remembered that any sea-going flotilla of this character accompanying a fleet would be encountered by a similar class of vessel attached to the fleet of the enemy, and their attention would be occupied with each other.

Neither have I alluded to frigates nor corvettes nor sloops nor gun-vessels, but it is evident that all vessels of inferior fighting power must depend for safety entirely on speed, and I deprecate the fatuity of building slow vessels of any class even for peace service. It would be much wiser, in my opinion, to rely upon a smaller number of swift vessels if we cannot afford to supply the full number required. Can we afford on the outbreak of war to see all these small slow craft captured? Independent of loss of prestige, will it be fair to sacrifice men and Officers in that way? And what an outcry will be raised!

I have endeavoured to shorten my remarks as much as possible, with a view to encouraging a greater amount of discussion, and for that reason I have chiefly limited my observations to the subject-matter named in the title of my paper. I have made little mention of torpedo attack, not because I undervalue its great importance in the strife for victory, but that it does not affect one way or another the tactics of ramming. I have also, for the same reason, avoided any reference to other classes of war-ships, such as frigates, corvettes, &c., and although it may be assumed that a certain number of frigates will be required as formerly to act as the eyes of the fleet, I have only offered one remark about those weakly-protected classes, which is that their greatest merit for the duties they may have to perform will be found to be in the possession of the very highest rate of speed.

As one of the old school of practical naval Officers, I have endeavoured to avoid trespassing on the domain of modern science, but I trust that my remarks may bear some good fruit through the discussion which will follow the reading of this paper, although I cannot expect that they will receive general acceptance, especially amongst gunnery Officers.

I do not think that the day will ever arrive when the engineer should take the helm in matters relating to ships-of-war, and it strikes me that there has been too great a leaning in that direction already, judging from such a wide divergence from what is truly practical as can be perceived in the composition of the Fleet of this country. The attack on the Alexandria forts has taught us little or nothing, but the first fleet action at sea will, I expect, revolutionize many features of equipment for battle which are now highly appreciated as evidences of scientific improvements, and the relative importance of the gun and the ram in the strife for victory will probably only then be ascertained.

We must hope, for the glory and safety of England, that in that day of peril it may be proved that our rulers have been wise in their generation, in giving the greatest prominence to gun attack and defence in the designs of armour-clads intended to operate together in fleet actions.

Captain P. H. COLOMB, R.N. : I shall confine myself, in the observations I have to make, to the title of the paper almost entirely, that is, "The Ram—the Prominent Feature of future Naval Victories," without attempting to follow the gallant Admiral into the perhaps more important parts of his paper. I think the proper attitude of mind, at any rate my own attitude of mind, is always this, in discussing questions of modern naval tactics, that I feel myself, as it were, in a bog, of which most of the substance under my feet is exceedingly unstable, and I find myself putting out a foot here and feeling a tussock and an apparent piece of solidity there, which I must test and try carefully before I attempt to rest upon it. I think if we all keep our minds in that condition we are more likely to get somewhat near the bottom of this excessively difficult and complicated question. I was much struck by a paragraph in the early part of the Admiral's paper, where he said the tendency was that our notions were regulated by the types of ships which prevail. That is a sentence with which I very fully agree. I think it is very important that we should know exactly how we stand in that matter. No doubt the types that prevail do sway our opinions sometimes unduly. It seems to me that tactical ideas, however rude, however rough they may be, are the elements which govern naval construction. Opinions announced in this Institution, although the utterers of them think no more of them when they are once announced, germinate and bear fruit, and are turned into material constructions ultimately. Then, when these material constructions are launched and in being, they again re-act on the naval idea of tactics, and so the two forces go on acting and re-acting on one another, and produce the structures which we have around us at the present day. It is quite evident, if that be true, that according to the definiteness and the truth of the tactical ideas which naval Officers entertain so will be the definiteness and the truth of the constructions which the Controller's Department of the Admiralty produces. Two things govern our tactics, and two only: the weapons and the power of locomotion. It is on these two things that the changes of our ideal tactics rest. That is very markedly seen in the case of the old fire-ship. The old fire-ship in the Dutch wars was the prominent weapon. The fleets in those days fought in large clusters, not in lines at all. Gradually the Dutch discovered that the proper way to avoid the fire-ship was to draw the fleet out in a thin line, which enabled the ships to open, when the enemy's fleet was to windward, and to let the fire-ship pass harmlessly through. No sooner was that discovery made, than the fire-ship began gradually to disappear, but the thin line then established was also useful for gun-fire; it was the best formation for using gun-fire from the broadsides of the ships, and the consequence was that it remained, and some of the tactical ideas surrounding it even remained until ten or twelve years ago. No change took place in the tactical ideas so long as there was no change in the propulsion and in the weapon. But the moment it began to be understood that steam was to dominate the fleet, thereupon different tactical ideas

began to develop themselves and resuscitated the idea of the ram, and the ram and the gun then fought for precedence for a considerable period. The torpedo springing up between these two weapons has largely modified the tactical ideas of every naval man, and is every day under our eyes modifying the constructions which these tactical ideas give rise to. The essence of tactics is to be strong where your enemy is weak; it is the course perfectly understood in all tactical arrangements, whether afloat or ashore, and that desire tends, as the Admiral has very properly put it, to equality. Ultimately, when everything is made perfect, you get equality; but of course that equality is ideal. The progress of skill and invention will always for a time leave one party superior to the other. It follows from this that if your guns and torpedoes be weak, you will attack with your ram; if your ram and torpedo be weak, you will attack with your guns; if the ram and guns be weak, there is the opportunity for the torpedo attack. But weakness may be also in defence as well as in attack. If the enemy's guns be strong, you take to the torpedo or the ram; if the enemy's torpedo be strong, you take to the guns or the ram; if the enemy's ram be strong, you take to your torpedoes and your guns. If we strengthen the ram, as the Admiral proposes, the enemy will naturally go to work to strengthen, not his ram probably, but his gun and his torpedo. The gallant Admiral considers (and it is the chief point in which I think I am rash enough to disagree with him) that you can force your enemy to meet you in a bow-to-bow attack; but even in his paper, when he brings the two ships together, he shows us incidentally that you cannot in point of fact force that attack. Strengthening your bow will not bring your enemy to put himself across it, nor to meet it in any way. It is the very thing that he will take every precaution to avoid, naturally. I think we need not on this occasion go into the question of attack and defence by the ram with fleets; it is better to take it as the Admiral has taken it, and to say, How can x , with a speed equal to that of y , force her to accept a bow-to-bow encounter? The Admiral of course admits that she does not accept; she goes away from it. What she probably would do would be this: seeing her enemy three or four miles off, she would naturally turn, not to bring him right astern at first, but to bring him on her bow, four points or thereabouts. By this action of y he is forced and cannot possibly help himself, to the same line of country if he wants to bring the action on. He must, if he has equal speed, bring his enemy as much on his bow as his enemy has brought x on her bow. Of course, if he gives up the fight and drops astern, he can do it, but see what happens. y , going to fight this kind of action, has naturally strengthened her broadside, quarter, and stern firing, either of guns or torpedoes or both; and it does not seem to follow—perhaps the Admiral in his answer will be able to show us how it is—that x should naturally gain, seeing that y has put him exactly in the position that he wanted him to be in, whereas y is exactly in the position that x did not want him to be in. x has desired to use his ram; y has said, "Not a bit of it. I mean to use my guns and torpedoes." It seems to me that the bow-to-bow encounter cannot be forced in that way. My own small researches have rather taught me that it is almost an axiom that you cannot force the nature of the action by turning towards the enemy; you can only force an *alternative* on your enemy by turning away from him. You can force him to fight astern of you or to give it up. But I do not see that you can do anything further than that in the way of forcing him. And what is true of the duel between two ships appears to me also, as far as I have gone, to be true of any properly constructed formation, because, after all, it is only an enlarged or prolonged ship. Now what will force action, as all history shows us, is superior speed; but it will not force the nature of the action, it will not settle how that action is to be fought out. I think it is quite right to dwell continually upon the enormous advantages of speed, as the Admiral puts it forward, and there I must say that my experience, and especially my late experience, is that that is a matter to which the Admiralty are as fully alive as to any other matter coming before them. I never was so struck with anything in my life nautically as when engaged officially in the trial of one of our larger ironclads, finding a few stokers apparently strolling about the stokeholes, all the draught-plates shut, apparently no work going on, and yet the ship was slipping through the water at 12 knots so quietly that it was difficult to realize it. Superior speed and strong attack from stern or quarter will dominate the nature of the

action. It is the only thing that will do it; that is to say, if an action is to be fought, and you have sufficient speed, you can insist that it shall be a stern or quarter action. You, of course, cannot say that you will make the enemy fight in that way, but you can say, "If he means fight, that is the way he shall do it," and I take it it is a great element of strength to be able to say to your enemy, "Now, if you fight at all, you shall fight as I desire, and not as you desire." It seems to me that is a reliable and strong point in tactics, one of those hard tussocks that you may put your foot on pretty steadily. I said that tactics consisted in the endeavour to be strong where your enemy is weak, and that that tended to equality; but in the case of the ram battle pure and simple I do not see that it does, except to an equality of skill. The broadside of the enemy's ship is always the weakest part of her as against the ram. The bow is always the hardest and the most dangerous part to hit, and I do not think that anybody will naturally go at the hard part if he can conveniently and with comfort go at the soft part. It seems to me that that is a logical position to take up. Manœuvring power, of course, will assist, and I am delighted to hear the Admiral dwelling upon that, because it is one as to which my belief is strong. When manœuvring power and skill are both superior, the ram will get the better of it, but not, I think, by the stem-to-stem or the bow-to-bow encounter. I think the stem-to-stem encounter, which is the only serious one in that way, is very difficult to obtain. I have held that idea for a long time, and all my recent experiences have confirmed it strongly. It will be very difficult indeed for two ships to hit one another stem to stem, even if they both do everything in their power to bring that about. Then as to the bow-to-bow encounter. That has been discussed very cleverly and exhaustively by Admiral Bourgois in a back number of the "*Revue Maritime*." The bow-to-bow encounter is a development which may very easily arise out of an attempt to make a stem-to-stem encounter, but this is a harmless form of encounter. I think a heavy-gun ship will not expose herself either to the ram or the torpedo if she can help it. I think she will endeavour, if she has speed, to prolong the gun action and the torpedo action as long as possible before the ram can be brought into play. And then it appears to me that the general policy that we have to follow would be to make the ram efficient certainly, but not to sacrifice too much to it, to understand always that you are to apply your ram in battle to the weak parts, and not to the strong parts of your enemy, and to understand that you cannot force your ram action. Well, then, I think, taking the whole thing, one might remark of any person who takes up the idea of running stem on to his enemy, and of the enemy who develops the same idea, instead of endeavouring to gain a tactical advantage over him, one might say, as was said of the charge at Balaclava, "*C'est magnifique, mais ce n'est pas la guerre.*"

Admiral Boys: I should like to be permitted to follow Captain Colomb, because he has expressed himself in words I should like to have used myself in giving my idea with regard to one point in this lecture. I allude to single action. Sir George Elliot's argument evidently is, that ramming will be the decisive manœuvre in future naval actions. That bow ramming is the surest method of carrying out that manœuvring, and therefore he strengthens the ship in the fore part to the sacrifice of more powerful armament and increasing some other means of offence and defence. I will say very little about fleet actions. My idea of a fleet engagement is, that if attacks with the ram are attempted too early or too indiscriminately, such a mass of accidents will follow that very little dependence can be placed upon the result. The first ship that rams another will be attacked of course with the ram herself, then another will ram that one, and there will be alternate ramming and ramming, probably an accidental ram from a friend astern, until it comes to what may be compared to a scrimmage at football. Another similarity to football is that the fastest and heaviest win, the difference being that where a man is knocked down at football he gets up again, which ships are not likely to do. Now with regard to the single action as described by Sir George Elliot. He is very strong upon the bow-to-bow encounter. The bow to bow, I presume, means direct stem ramming; but look at the bow of that ship in the diagram, and tell me how from a considerable distance off it is possible for a ship to make certain of striking another at such an exact spot that their stems are to meet; because if they do not strike directly in that way it will be a glancing blow. While on this subject, I

should like to point out that I think it a great mistake to place numerous projections on the sides, as there are on some of our ships, for the purpose of mounting Nordenfolt guns and for barbette towers, in order to get head and stern fire; for I am sure that these projections will suffer very much in glancing blows from the ram, and they will be the means of injury to the ship instead of an advantage to her. We know that in oblique fire, if the point of the projectile enters, there will be penetration, but if you do not get the point to bite it will glance: and in the same way, if the enemy's ship's stem comes in contact with some of these projections in our ships, I think you will have serious damage done from which it would otherwise be free. The ship should be as smooth outside as possible. In the case of ships advancing towards each other at 10 knots an hour, they will pass over 1,000 yards in something under two minutes. I take it that 1,000 yards may be called the "measurable distance" for an attempt to ram, because beyond that distance the enemy's formation (if a fleet) or direction cannot be made out, and there is no time to change a plan of attack. In the case of the two ships x and y , x is especially prepared for bow-ramming as described, y has a more powerful broadside armament; x and y are meeting each other at 10 knots. I maintain that if y sheers off four points, as Captain Colomb says, before closing to 1,000 yards, and reduces her speed somewhat, not only with a view of avoiding the ram, but to deceive the enemy, and turn shorter, and then alters back two points, what is x to do? x wants to ram; he must put his helm over at the same time, or as soon as possible after having reduced speed; x will go faster through the water, and although she is steering towards y , will in all probability slip across y 's bows, and if y does not ram x , y will pass under her stern and then range up on the other side, broadside to broadside, and will get the advantage of her heavier armaments. I maintain that two ships of equal speed broadside to broadside, two cables apart, cannot ram each other. Sir George Elliot referred to the double- and single-barrelled turrets, and he said he would prefer three single-barrelled to two double-barrelled ones. Where you have three turrets in a ship, one must be placed amidships between the other two, the bow and stern fire of the midship turret is obscured by the other two, and therefore I think the maximum of heavy bow fire which the lecturer seems to dwell upon with the three turrets will not come to pass. The Admiral has not apparently made a distinction between towers and turrets. By way of explanation, I would point out that a turret is thoroughly covered and revolves with the gun; while a tower is a fixture, the gun revolves about it, and is open to heavy machine-gun fire. With regard to smoke, I wonder something definite has not been arrived at. I once had an opportunity of making a trial with a squadron of turret-ships by firing at targets when in close order in line ahead, going 8 or 9 knots. The conclusion was that there was no impediment to gun-fire from the smoke whatever, and I think ships going at that speed in a general action will find very little, and if there is any, it will be the duty of the Admiral or Officer in command to endeavour to gain the most advantageous position, as was formerly done, to get "the weather-gauge." The subject of the lecture is "The Ram—the Prominent Feature of future Naval Victories;" but I must, with all diffidence, venture to offer a warning against too promiscuous and uncertain attempts at ramming, because so much chance is involved, that they might develop into future naval defeats instead of naval victories.

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should have run slap into her. What would have happened I cannot say. Sir George Elliot says that it is unlikely ships will meet at full speed; that is a point on which I have thought a great deal, and I wish to express a very different opinion. My opinion is before you go into action you must make up your mind within very narrow limits what speed you mean to go at. A modern ship has, I do not know how many boilers, but never less than six. They all have steam up at a great pressure. Now you cannot tell your engineer to go slow and fast alternately with all this steam. What is he to do with it? I have talked to several very intelligent engineers on the subject, and I thought it a matter of so great an importance that I did not like to express my own unaided opinions, and so I applied to a great authority on the matter, Mr. Richard Sennett, and he agrees with me that it would be inexpedient to alter your speed greatly and frequently during an action. I do not say that it would not be necessary sometimes to vary the speed of a ship, but I should always prefer reversing at full speed to altering the revolution of the engine. As to handiness I think there is no doubt whatever, the great thing affecting handiness, *ceteris paribus*, is speed. Turning power as ships are now fitted is undoubtedly a function of speed. If you look at the turning diagrams of the "Thunderer" you will find when she was going 11 knots she turned faster and shorter than when going at 9 knots. Therefore, if I am to utilize the ship committed to my charge in the best way possible, I must take that ship into action at the greatest speed at which she can go conveniently. That is what I should do. The Admiral speaks of the gain of a few minutes with reference to something that occurs in the imaginary battle at Port Saïd. This is not a question of minutes but of seconds. A ship 300 feet long, going at 12 knots, will pass over her own length in 15 seconds, and the other ship the same; the consequence will be that the time during which these two ships will be in a position (where they have to turn) to ram each other will be $7\frac{1}{2}$ seconds; minutes do not enter into it. The relative merit of the armour-belt and the raft-body with the coffer-dam side is a subject on which Sir George certainly has the right to speak with great authority, for his services to the country in that matter have been very great. I think the merits he speaks of are quite recognized by our Constructors, for last year Mr. Barnaby clearly pointed out that he thought the day was not very far distant when armour would be done away with. It seems to me a mere matter of expediency at the present moment. No doubt if guns increase in power and torpedoes increase in power you will have to do away with armour; but what the principal naval architects go upon is, what ships have other Powers got? We do not want to build a lot of expensive ships, but we must keep this country ahead of other Powers, and if they build other ships we shall build others too. We have much greater power in that way than any other nation in Europe; we can always build to match them. At this moment I do not feel competent to give an opinion as to whether armour should be done away with. Take the "Warspite," an efficient fighting ship. The armour is only 140 feet long and 8 feet wide; and yet if that armour were taken off her, it would make a difference of something like 200 tons, supposing the 3-inch steel deck is continued where the armour had been. If you gained that 200 tons what would you do with it? If you put it into engines it would not give you half a knot; if you take it in coal it would perhaps be the most useful thing to do. Then we come to the question: It is important to decide whether the ram or the gun should dominate construction. I think that is a very important question, but I think there is another weapon which claims perhaps equal if not greater attention, and that is the torpedo. I have in my hands the specification of Sir Edward Reed's patent ship, designed to resist the attacks of torpedoes and also of guns, and I will hand it to the Council in case they may like to append it to the proceedings. As far as my ideas are worth anything, I should say give us protected steering-gear, protected motive power, protected magazines and the channels for handing up the ammunition to the guns. If you protect those against shell then I think we have got all we can expect. Of course we must do our best with what we have got, but give us, above all things, speed. The first of qualities I say is speed. We come now to the order of qualities. In Class A Sir George Elliot puts speed second, and in Class B fourth. Now I cannot agree to that. I should always put sea-going first and speed second in every ship. I have followed for some years with

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Captain LONG, R.N.: In the first place I should like to return my thanks to Sir George Elliot for bringing this matter before us. The paper contains a great number of important points, a few of which I feel bound to express an opinion upon. First with regard to bow-to-bow ramming. I have had the fortune to command a ram, so that I have been obliged to consider that question; and often remembered Sir George's apt illustration of the two eggs, which, however, points to a conclusion diametrically opposed to what we heard from Captain Colomb. Though I cannot give any opinion on the theory, I made up my mind that if I had in H.M.S. "Curaçoa" to engage a vessel like the "Garnet," of about the same tonnage and much weaker in structure, I should certainly have kept that ship right ahead of me the whole time, and if I had superior speed I should certainly have run into her or she would have had to run away. If she had presented her bow to me I

should have run slap into her. What would have happened I cannot say. Sir George Elliot says that it is unlikely ships will meet at full speed; that is a point on which I have thought a great deal, and I wish to express a very different opinion. My opinion is before you go into action you must make up your mind within very narrow limits what speed you mean to go at. A modern ship has, I do not know how many boilers, but never less than six. They all have steam up at a great pressure. Now you cannot tell your engineer to go slow and fast alternately with all this steam. What is he to do with it? I have talked to several very intelligent engineers on the subject, and I thought it a matter of so great an importance that I did not like to express my own unaided opinions, and so I applied to a great authority on the matter, Mr. Richard Sennett, and he agrees with me that it would be inexpedient to alter your speed greatly and frequently during an action. I do not say that it would not be necessary sometimes to vary the speed of a ship, but I should always prefer reversing at full speed to altering the revolution of the engine. As to handiness I think there is no doubt whatever, the great thing affecting handiness, *ceteris paribus*, is speed. Turning power as ships are now fitted is undoubtedly a function of speed. If you look at the turning diagrams of the "Thunderer" you will find when she was going 11 knots she turned faster and shorter than when going at 9 knots. Therefore, if I am to utilize the ship committed to my charge in the best way possible, I must take that ship into action at the greatest speed at which she can go conveniently. That is what I should do. The Admiral speaks of the gain of a few minutes with reference to something that occurs in the imaginary battle at Port Saïd. This is not a question of minutes but of seconds. A ship 300 feet long, going at 12 knots, will pass over her own length in 15 seconds, and the other ship the same; the consequence will be that the time during which these two ships will be in a position (where they have to turn) to ram each other will be $7\frac{1}{2}$ seconds; minutes do not enter into it. The relative merit of the armour-belt and the raft-body with the coffer-dam side is a subject on which Sir George certainly has the right to speak with great authority, for his services to the country in that matter have been very great. I think the merits he speaks of are quite recognized by our Constructors, for last year Mr. Barnaby clearly pointed out that he thought the day was not very far distant when armour would be done away with. It seems to me a mere matter of expediency at the present moment. No doubt if guns increase in power and torpedoes increase in power you will have to do away with armour; but what the principal naval architects go upon is, what ships have other Powers got? We do not want to build a lot of expensive ships, but we must keep this country ahead of other Powers, and if they build other ships we shall build others too. We have much greater power in that way than any other nation in Europe; we can always build to match them. At this moment I do not feel competent to give an opinion as to whether armour should be done away with. Take the "Warspite," an efficient fighting ship. The armour is only 140 feet long and 8 feet wide; and yet if that armour were taken off her, it would make a difference of something like 200 tons, supposing the 3-inch steel deck is continued where the armour had been. If you gained that 200 tons what would you do with it? If you put it into engines it would not give you half a knot; if you take it in coal it would perhaps be the most useful thing to do. Then we come to the question: It is important to decide whether the ram or the gun should dominate construction. I think that is a very important question, but I think there is another weapon which claims perhaps equal if not greater attention, and that is the torpedo. I have in my hands the specification of Sir Edward Reed's patent ship, designed to resist the attacks of torpedoes and also of guns, and I will hand it to the Council in case they may like to append it to the proceedings. As far as my ideas are worth anything, I should say give us protected steering-gear, protected motive power, protected magazines and the channels for handing up the ammunition to the guns. If you protect those against shell then I think we have got all we can expect. Of course we must do our best with what we have got, but give us, above all things, speed. The first of qualities I say is speed. We come now to the order of qualities. In Class A Sir George Elliot puts speed second, and in Class B fourth. Now I cannot agree to that. I should always put sea-going first and speed second in every ship. I have followed for some years with

great attention the opinions professed by various Officers on the subject of naval tactics, and anything more different or more unsatisfactory it is not possible to conceive. There are no two opinions that agree; therefore I say, do not let us build ships to meet notions which are evidently entirely different, but let us take the single-ship action that Captain Colomb takes, let us have those qualities which are of use in single-ship actions, that we know all about, the first of those qualities, sea-going; second, speed and handiness; the third, offensive power; guns, torpedoes and rams, and armour, I should relegate to a secondary consideration, only requiring it to protect vitals. Then the only difference I should make between Class A and B is that I should give the class for foreign service, sail-power. That, I think, is still necessary. And here I wish to express my admiration of Captain Noel's paper. I think he has exactly hit the nail on the head. What we want is to have sail-power which can be used when we want it, and can be put away when we do not want it. That was very forcibly brought before me in the "Curaçoa." I used to attempt to clear the masts ready for action, but I found we were much hampered by lumber on deck. I think Sir George Elliot's tripods are good in principle, and the Commodore at Hong Kong remarked that we ought to have very large tops fitted with shields to carry powerful machine-guns. That is one of the objects for which masts are still very useful. In China the Admiral did make an alteration in the sparring of the C class of corvettes under his command, and gave them 1,200 feet more canvas by giving them longer yards. But, after all, the great defect of that class of ship is that her steering-gear is not protected, and that is most serious, for it seems a mistake to protect the motive power and not the steering-gear, which is of equal importance. The Admiral himself in his paper has fully echoed what I said about speed, because he says he deprecates the fatuity of building slow vessels of any class. With that notion I most entirely concur. I fought out the question of x and y on one occasion with Captain Colomb, and I quite agree with what the Admiral says about it. Eventually I must turn tail. Now I think there is only this to be said about it: that when y turns tail (as I believe the torpedo has received very considerable improvements) it becomes a serious question whether you would dare to approach an enemy astern if you knew that she was furnished with Whitehead torpedoes. I think it is hardly fair to say that *Lissa* was won with a ram, for there are many other things to be taken into account. Then we come to the form of spur. I read that chapter of Sir Edward Reed's about ramming, and I must say, after considering the matter, I am not prepared to go off from the existing form of spur, because if you look at that ship's bow and stern, you will see if you ram her astern you will have to go through the whole of that overhanging armour before you get to her rudder or screws. Then as to the experiments on the effects of projectiles on cellular construction. That is a very important matter. It was recommended by the Committee of Designs in 1871, and again by Sir James Hope's Committee six years ago; and as Sir George Elliot thinks it is still necessary, I cannot help thinking that it is extremely important that experiments should be made in that direction. I must express the admiration I feel for the naval Officers, engineers, and naval architects who have conducted the Navy through the revolutions which it has experienced since I commenced my career. Within the last thirty years the Navy has undergone two or more reconstructions, and I think the ability shown by all parties in doing that must give us the greatest confidence that whatever is necessary will be done in the future.

Colonel Lord WAVENEY: I have derived from the remarks of the gallant Officer who has just spoken, how common to both land and sea services are certain difficulties. I was a little startled at hearing that he proposed to dispense with armour on ships. I imagined that probably when there was a question of hard blows going that armour might be an advantage, but I recollect at the same time what he has stated as to his own determination on what principles to fight, in case he should be brought into the presence of an enemy, viz., to go ahead and depend on his speed, and then I remembered very probably some such arguments as that induced the European nations to give up the heavy armour of the gendarmerie,—speed was required; it was speed that sent our men through the Russian troops at Balaklava, and therefore it is, I presume, that speed is to be taken as a great consideration.

Now with regard to another point, the necessity of protection. I had the opportunity of observing the necessity of protection during that action at *Lissa*, of which mention has been made. The vessel, I believe, that was sent to the bottom was the "*Ré d'Italia*," and it was stated by Sir Edward Reed that we declined to admit that vessel into the British service on account of some fault of construction. But in the action was the "*Affondatore*," a very long vessel which I saw afterwards in the dockyard at *La Spezia*. The engines were surrounded by an open gallery, protected by winding partitions, and it would certainly have been supposed that her engines would have been protected from vertical as from horizontal fire by her armoured face. But in the very centre of this gallery, and close to the engines, was the dent of a round shot that in that action had travelled so far, and if it had travelled a little further the "*Affondatore*" might also have been lost.

Captain the Hon. E. FREMANTLE, R.N.: I am sure we have already had a most interesting discussion, but as I am more in agreement with what has been said by the lecturer than many of those who have spoken, I feel inclined to say a few words. I myself attach very great value to the strength of the bow. I quoted Admiral Elliot in an essay which had the honour of taking the prize at this Institution some four years ago, and I feel bound cordially to support him now. I think we may refer a little to history, and when we look back at fleet actions we shall see how many of them were partial actions, and that it was not until the Admirals found that it was possible to put their ship's bow on to the enemy, and by cutting through the line, to gain a victory, that any great successes were gained. I think that shows that there is some value in being able to put your bow towards the enemy. It is simply that you move by the bow and not by the stern; consequently if you put your bow towards the enemy you are more likely to bring on decisive action. As to single-ship actions and fleet actions, it has been assumed, certainly by Captain Colomb, that they are exactly on all fours. Now, to my mind, they seem to differ very considerably. I do not deny but what we may by analogy take example by a single-ship action in arguing on fleet actions, but I think if we refer to history we shall see in how many instances there were partial fleet actions, and in how very few instances there were partial single-ship actions. That points to my conclusion that there is a very essential difference, and that essential difference should be worked out in describing single-ship actions and fleet actions. I endeavoured to explain a single-ship action in my essay, and I certainly thought, and do think, that speed is of primary importance in a single-ship action. I think with Captain Colomb that you can force the enemy if he has inferior speed to you, although he may have greater manœuvring power, to fight you and in the way you desire, and so gain the action. I deny that it is exactly the same in a fleet action. I think on the contrary it is impossible to manœuvre a fleet of twelve or twenty ships with the same ease that you can a single ship. I would like to understand from the lecturer exactly what he means with reference to the cellular compartments. He has spoken perhaps a little too much as if cellular compartments were unknown in the British Navy and in foreign navies. There are people here who are much more fitted to explain what has exactly been done in the way of cellular construction than I am, but I may say this, that although Admiral Elliot appears to have assumed that foreign ships are large weak ships, as if they had not adopted cellular construction at all, I am under the impression that the Italians in the "*Italia*" and "*Lepanto*" have carried the system of cellular construction to its fullest extent. These ships have two armour-plated decks 4 feet only apart, and between those two armoured decks they had a very large number of cellular compartments. I myself am perfectly in favour of strengthening the bow, and to return to that question I should say it appears to me that the French ships with their armour-plating carried down to the water-line, bringing it down to join the ram at the bow with the lower armoured deck, have gone far to strengthen their bows, and have given more attention to that subject than we have. It appears to me on the whole that more attention has been paid to the important question of armoured bows in foreign navies than it has in our own, and I agree with Admiral Elliot in considering the great importance of having the bow extremely strong. I believe that our new ships

of the "Admiral"¹ class are now being built very much on the principle to which I have alluded as being that adopted in the French ships such as the "Admiral Duperré," and I hope that this is the case. I do not wish to go into the question as to meeting bows on, it is one which can only be decided by experience, but I do think that if I was in command of a ship or a fleet, and I knew that my ship or squadron had stronger bows than the opposing squadron, I should not shrink from attempting to meet them either bows on or stem on.

Admiral GORE-JONES: I rise only to make a few remarks which I should like to hear discussed by Sir George Elliot in his reply. There is one thing which I think of very great importance, which is the uncertainty in the use of the ram, and one fact is worth a great many ideas. During the French and Prussian War an action took place between two gunboats in the neighbourhood of Havana: it was a duel. The German, I think, was first on the ground, and he watched to observe how his adversary would attack him. It was evident to him that she was coming down intending to ram; he just got way on his ship and watched. When he saw that there was no doubt that the French ship was coming right down on him he put his helm over and took the ram on his bow. This was a case where the blow amounted to nothing; the French ship glanced along and no damage was done, but the German seeing what was going on had trained all his guns extreme forward. The French ship passed so close that she turned all the muzzles of the guns as she went along, and as they turned one was fired and the shot went into the steam-chest. They went on and separated a little, but they had scarcely parted before the German found that his screw was caught in the top hamper coming down from aloft, and thus both were *hors de combat*.

You see here—

"The best laid schemes o' mice and men,
Gang aft aglee."

The idea was to ram; the result was the ram had no effect whatever, while the shot burst the steam-chest of one, and the top hamper stopped the screw of the other. The Frenchman then made sail and got within the three-mile line which put her in Spanish waters, and this was the result of the only action I know where pure ramming was intended. Thus every element, ramming, gun-fire, disabling screw, making sail came into practice, and the ramming was the least effective. The Battle of Lissa is not a fair instance, because the Captain told me himself he tried three times to ram, and it was only the third time that he succeeded. That was a fair broadside attempt. The corollary that I think may be deduced from the debate to-day is this, that the ram is a most powerful weapon, but it ought to be a weapon, like cavalry in the Army, used for its own purposes and for nothing else. Another thing is the ship ought to have no fighting power in it except the ram. If you give a weak man the option of firing guns and creating smoke instead of ramming as he ought to do (doing nothing until he does ram), then he will watch his opportunity and perhaps succeed. The second point is the screw. As long as screws are unprotected the slightest top hamper, a net thrown overboard, anything will stop a screw at once; therefore, any ram must have a protected screw. It has been proved that speed is rather increased by the screw being covered over, and while I do not wish to enter into the general question, I certainly am of opinion that if two vessels of tolerably equal power and intelligence in guiding them met in a duel they would never ram one another, it would be something like the hare and the greyhound, short turns and all the little manœuvring would prevent a direct ram, and if it is not a direct ram I do not see that it is of much use. I quite agree with Captain Colomb that in the pursuit of a vessel, keeping end-on as the Admiral proposes and trying to ram her, he would not succeed. Another point is that allowing a vessel going 11 knots to come up with another only going 10 knots, the blow struck by that vessel (both vessels going in the same direction) would be very small. No ram ought to have top hamper, she ought to be turtle backed, to have great speed and quick turning power, and her screw ought to be well protected.

Lord WAYNEY: In continuation may I be allowed to state correctly what took

¹ I understand that I was mistaken in supposing that the armour-belt is to be carried right forward in the ships of this class.

place at Lissa. Captain Colomb in a paper which he read on this subject says: "After several failures, partial rubs, and total misses, one Austrian ship, the 'Ferdinand Max,' sees ahead of him a grey mass, it goes full speed at it and hits it fair. The shock to her does not appear heavy and does no damage; the huge grey mass, however, surges over 45°. The 'Max' backs astern, and looks with somewhat of awful curiosity for the result of her blow. It is not long doubtful. The 'Réd'Italia' tumbles back again. There is terrible confusion on board, for the water is roaring into her like a cataract. In two or three minutes the victim plunges heavily down, and leaves nothing to tell of her whereabouts but a few shrieking struggling remnants of her ill-fated crew of 600 men. 400 souls they say went with her to the bottom."

Captain NOEL, R.N.: There are two questions which I think I might treat shortly; one is the comparative value of the ram and guns, and the other is the strength of the ram-bow. It is not easy to compare the ram and guns as separate arms. In the first place the ram is required in certain circumstances, and the guns in entirely different circumstances. I am very averse to giving up either the ram or the guns in any ship whatever. There are cases in which the ram will be of infinite value, and there are cases when the ram can do nothing. The ram is, I consider, the arm of first importance in a general action, not that a ship is necessarily to manœuvre out of her squadron in order to ram, but I believe that there would be great opportunities for ramming in a general action, where ships are obliged to keep with their consorts. If the squadrons do meet, the ships will be able to ram by merely diverging a few degrees. Therefore, I hold that the ram is the first weapon in a general action. The guns, I have always maintained, should be of secondary consideration in the first attack; afterwards, when the ships pair off, possibly they will take their place as in single action; torpedoes and guns will in these circumstances be on very much the same footing. The next point is the question of duels. In single-ship actions the ram will not be of the first importance, the gun will take the priority. Captain Colomb says, "You cannot force your enemy's mode of attack;" I must say I do not agree with this statement. Perhaps you may not be able to force him to meet you bow to bow, but you can force him—as our gallant lecturer tells us—either to meet you bow to bow or else to run away, when you can follow in his wake. If you have greater speed than he you can ram him, because you can watch him and turn on him; or if he does meet you bow to bow, and you have greater manœuvring power, you may miss *that* chance, but by turning as quickly as you can, you are into him before he can turn again. Where speed and manœuvring power are equal no doubt the gun is the principal arm in a single action; but towards the close the use of your ram comes in; your enemy may be to a certain extent disabled, you consequently have the speed of him, and he is at the mercy of your ram. If we go to the further question of ships against forts, or flotillas of boats, rams and torpedoes are useless, and your guns are of paramount importance; therefore, you must have considerable gunnery power in every ship. I do not hold at all with a vessel that carries no guns. As regards the construction of the ram, I am afraid that very few of our ram-bows are as strong as they ought to be. At Portsmouth, yesterday, I made a point of going on board the "Camperdown." I measured the bow of that ship. They have just placed the plates which form the bow supports to the stem, and 20 feet from the point of the ram inboard is only 8 feet across. Now, I think if there is that sharpness in the bow of any vessel she is bound if she rams the enemy to penetrate those 20 feet, and should there be a wrench then, such a bow could not possibly stand the lateral strain. I think we want a very much more secure root for the ram; I should prefer seeing a bow constructed after the plan of the "Polyphemus" (without the tube inside); that is a conical bow, a long fine cone with a ram at its point growing right out of the body of the ship, and rounded, above and below, into the shape of the bow. I do not think you would lose any speed by so constructing the ram-bow. It would be an exceedingly interesting experiment if a wooden structure of this form were put on to one of these vessels, and trial made to ascertain what alteration there would be in her speed. Such a construction immensely increases the lateral strength, the armour-plated deck may possibly be sufficient to prevent the bows of our rams from being crushed in, but is not capable of dealing with lateral strains, which will be

enormous. I must say I should like to see it a recognized principle with every naval Officer who commands one of Her Majesty's ships, that he *will* ram if he possibly can do so, and in that I fully agree with Captain Long. Another question I will briefly refer to, namely, that of protecting the vital parts. The object should be to keep the ship's speed and manœuvring power intact, and also to keep up the communications between the deck and below. Let all the guns be blown to atoms, and the torpedoes all come to grief, but we must have the ship so protected as to maintain her speed and her manœuvring power to the last moment, and so that the Captain may have his communications open; can this be done without side-armour? Again, as regards the raft body *versus* armoured sides, with all due respect to Sir George Elliot's opinion, I think any Constructor would object to put engines and boilers under the deck represented in that drawing; I am afraid there is not room. By substituting armoured sides you have the necessary room for your engines. Another view of the question is, that if we depend so much for our floating power on the part below the raft-body being intact, we are apt to forget that a torpedo exploded under this part is all the more serious; compartments below are filled, and we may have no topwork which is not knocked in, to help in supplying the necessary buoyancy.

Captain FITZGERALD: One cannot help feeling in discussing the ram and all naval tactics how exceedingly speculative it all is; that we really know nothing about it. We may gather this from the great divergence of opinions which we hear all round. With regard to speed, I venture to disagree with Sir George Elliot in placing speed fourth in Class B; I think we should almost place it first; I certainly should put it before seagoing qualities. There is always a certain risk at sea, and there would be no honour and glory in going to sea if there was no chance of being drowned. I certainly agree with what Captain Colomb said, namely, that you could not *force* an "end-on" attack. I venture to disagree there with Sir George Elliot. Captain Long gave us some personal experiences of his ship, the "Curaçoa," and said if he had to attack a ship with an inferior bow he would go straight at her regardless of consequences. He seems to assume that he is going to jump over the space between him and that ship like a bird; but he is bound to expose his bow equally to the other vessel; he must do so in order to get where she is going to. If his judgment is quite correct as to speed and distance (say they were of equal speed), and if he has fixed in his mind the spot in the water where she is to be, if he has done this correctly and the other ship slacks speed ever so little, she will exactly reverse the whole thing, and she will ram him instead. I think we cannot override this little point when we assume that we are going to ram here and there, namely, that there are two people to the question. It is the fashion on these occasions always to mount one's own hobby, and I should not like to be out of the fashion. My great hobby is to *try* all this with gunboats; instead of being speculative we should then really arrive at what we could and what we could not do with regard to forcing an end-on attack with the ram, and settle various other points of interest.

The CHAIRMAN: I will now return our best thanks to Sir George Elliot for his very valuable and suggestive paper.

Friday, February 29, 1884.

ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B.,
Vice-President, in the Chair.

GUNPOWDER CONSIDERED AS THE SPIRIT OF ARTIL-
LERY, WITH THE RESULTS WHICH HAVE FOLLOWED
AND WILL FOLLOW THIS VIEW OF ITS POSITION.

By Colonel C. B. BRACKENBURY, R.A., Superintendent Royal
Gunpowder Factory, Waltham Abbey.

THE title of the paper which I have the honour to read to-day may appear to some of you a little fantastic, yet it represents exactly what needs to be said on this subject. You will perhaps say inwardly, though politeness will prevent the outward expression of your thought—"Of course, nothing like leather; the head of the Royal Gunpowder Factory will glorify gunpowder." In reply to this perhaps you will acquit me of egotism in stating the fact that many years ago, when I had no more idea of ever holding my present position than I had of becoming King of Madagascar, I wrote an article on gunpowder headed the "Soul of Artillery." My present views on the question are but developments of those which were then expressed, developments which naturally follow the progress of knowledge.

We constantly hear that a gun has been produced which will do this or that, yet it is not the gun which does it, but the gunpowder. The gun is only a tube to concentrate the action of the powder and guide the projectile. There is not a single gun actually adopted for service in any country which is not, by its weakness, a hindrance to the full action of the "Spirit of Artillery." When gun-makers say, as they frequently do, that their gun will produce a certain effect "provided that a suitable powder be found for it," they mean "provided that the strength of gunpowder be restrained, 'cribbed, cabined, and confined' to suit the weakness of the gun." We sometimes see in human life a great and strong spirit tear to pieces a feeble frame which contains it, and we do not say, "What a pity that the spirit is so strong," but rather, "How sad that the body is so weak." In the case of artillery we are always subduing and taming the spirit instead of strengthening the body. This may be necessary under existing circumstances, but, if so, the circumstances are

unfortunate, and stand in the way of getting the most value out of the Spirit of Artillery.

Yet, what a marvellous career this spirit has run. When it appeared in Europe, the most potent master existing was the Spirit of Chivalry. And what was this spirit? Glorified by poets and endued with prismatic hues by the mists of time, it began by protecting the weak against the strong, but degenerated and came at last to strengthening the strong and weakening the weak. If some knights went about the world redressing the grievances of ladies, that shows that ladies had terrible grievances to redress. There were good knights and bad knights at all times, and the power of the law was not sufficient to restrain the bad ones. For one *Ivanhoe* there were probably a good many *Front-de-Bœufs*. "O, but the knights were bound to obey the behests of their lady loves and run all sorts of dangers to please them." Yes, but if the tasks set were too hard and dangerous we read of knights slapping the ladies' faces when the deed was successfully achieved. And, as for fighting, the knights were at last so covered with heavy armour that the poorer foot soldiers had no fair chance in combat. At *Crécy* the French knights rode down their own archers because they were in the way. Finally the knight had to mount his horse before his armour was put on. He was then quite invulnerable unless his horse fell with him, and the difficulty of killing him on the ground was so great that there was plenty of time for his friends to succour him. Besides, he was generally treated with tenderness in view of a heavy ransom. The defensive armour of a knight was stronger in proportion to his wealth. James I said of later armour that "it was an admirable invention, which preserved a man from being injured, and made him incapable of injuring anybody else." This was the point to which chivalry, an admirable institution at first, had come.

Into a world so ordered was born the "Spirit of Artillery," weak and hesitating at first when the firearm was less powerful than the crossbow, and when a writer of the fifteenth century could say that an artilleryman more than anyone else should always have before his eyes the fear of God, because "the great strength and force" of gunpowder "constantly causes the cannon which they fire to burst." The spirit is recognized as a living agent "grievous and terrible through its desire to kill and destroy the artilleryman by means of the great ills, and mischiefs, and damages it does to him in its vocation and trade."¹

Monluc, who fought under Francis I, speaks of the growing power of gunpowder, saying that the arquebus "discharged by cowardly and base knaves," which was the chivalrous way of describing foot soldiers too poor to afford armour, struck down many brave men with plenty of money. The Spirit of Artillery was at work levelling distinctions in the field, destroying the shams which had clustered round chivalry, and forcing every human being to stand on his own courage and prowess, instead of on invulnerability purchased by the rich and denied to the poor.

¹ "Arms and Armour." By Charles Roulett.

In the contest between gunpowder and armour the gunpowder won a long time ago. A similar contest is going on now. Rich nations build mighty ironclads, and put them on the sea like knights in heavy panoply. The Spirit of Artillery will win in the struggle as it did of old, and it is possible that the same result—the abolition of armour—may follow when the victory is clearly decided. Ironclad ships are now boxes containing a complicated mass of machinery, and comparatively but few men. First rate men-of-war used to cost 1,000*l.* per gun. Some late examples—the “*Italia*” for instance—cost something like 100,000*l.* per gun, and much more if we only count the big pieces able to pierce armour equal to that of their own ship. Fancy the value of 1,000,000*l.* going to the bottom as it may from the result of one blow, and then think how closely the Spirit of Artillery is following the same course as once resulted in the abolition of a degenerate chivalry, the excessive power of the strong over the weak, the rich over the poor.

We will now turn, if you please, to the examination of this spirit, and see how much we know about it, and how it is getting on with its growth.

And, first of all, what is its actual strength?

The difficulty of the subject, as treated from a philosophical point of view, has been illustrated by the extraordinary differences in the theoretical results arrived at by different investigators. Starting with the year 1702, De la Hire supposed that the force of fired gunpowder arose only from the expansion of the air lying within and between the grains, this expansion being caused by the heat developed in the action of combustion.

In 1743 Robins crushed this theory by showing that it would only account for about a 200th part of the force actually arrived at. Robins added the effect of the permanent gas developed from the powder which, raised by the heat, would give a force equal to 1,000 atmospheres.

Five-and-thirty years afterwards, in 1778, Dr. Hutton communicated to the Royal Society his researches on gunpowder, which showed a great advance over those of his predecessors. He calculated the force of fired gunpowder at about double the amount arrived at by Robins, and called it 2,000 atmospheres. But the laws of thermodynamics had not been discovered in his time, poor man, so his views are quite obsolete now.

Then, in 1797, Count Rumford attacked the subject again, and reported to the Royal Society a series of experiments in which he supposed himself to have proved that this tricky spirit of fired gunpowder, when kept tightly bottled up, was capable of exerting a force equal to the pressure of no less than 101,021 atmospheres, that is, 662 tons on every square inch.

In 1823 Gay-Lussac reported his experiments, and decided that the permanent gases would, at the freezing point of temperature, occupy a space 450 times greater than the powder from which they were derived. Piobert, however, promptly demolished his figures, showing that by some error in calculation his results were double what they

unfortunate, and stand in the way of getting the most value out of the Spirit of Artillery.

Yet, what a marvellous career this spirit has run. When it appeared in Europe, the most potent master existing was the Spirit of Chivalry. And what was this spirit? Glorified by poets and endued with prismatic hues by the mists of time, it began by protecting the weak against the strong, but degenerated and came at last to strengthening the strong and weakening the weak. If some knights went about the world redressing the grievances of ladies, that shows that ladies had terrible grievances to redress. There were good knights and bad knights at all times, and the power of the law was not sufficient to restrain the bad ones. For one *Ivanhoe* there were probably a good many *Front-de-Bœufs*. "O, but the knights were bound to obey the behests of their lady loves and run all sorts of dangers to please them." Yes, but if the tasks set were too hard and dangerous we read of knights slapping the ladies' faces when the deed was successfully achieved. And, as for fighting, the knights were at last so covered with heavy armour that the poorer foot soldiers had no fair chance in combat. At Crécy the French knights rode down their own archers because they were in the way. Finally the knight had to mount his horse before his armour was put on. He was then quite invulnerable unless his horse fell with him, and the difficulty of killing him on the ground was so great that there was plenty of time for his friends to succour him. Besides, he was generally treated with tenderness in view of a heavy ransom. The defensive armour of a knight was stronger in proportion to his wealth. James I said of later armour that "it was an admirable invention, which preserved a man from being injured, and made him incapable of injuring anybody else." This was the point to which chivalry, an admirable institution at first, had come.

Into a world so ordered was born the "Spirit of Artillery," weak and hesitating at first when the firearm was less powerful than the crossbow, and when a writer of the fifteenth century could say that an artilleryman more than anyone else should always have before his eyes the fear of God, because "the great strength and force" of gunpowder "constantly causes the cannon which they fire to burst." The spirit is recognized as a living agent "grievous and terrible through its desire to kill and destroy the artilleryman by means of the great ills, and mischiefs, and damages it does to him in its vocation and trade."¹

Monluc, who fought under Francis I, speaks of the growing power of gunpowder, saying that the arquebus "discharged by cowardly and base knaves," which was the chivalrous way of describing foot soldiers too poor to afford armour, struck down many brave men with plenty of money. The Spirit of Artillery was at work levelling distinctions in the field, destroying the shams which had clustered round chivalry, and forcing every human being to stand on his own courage and prowess, instead of on invulnerability purchased by the rich and denied to the poor.

¹ "Arms and Armour." By Charles Roulett.

In the contest between gunpowder and armour the gunpowder won a long time ago. A similar contest is going on now. Rich nations build mighty ironclads, and put them on the sea like knights in heavy panoply. The Spirit of Artillery will win in the struggle as it did of old, and it is possible that the same result—the abolition of armour—may follow when the victory is clearly decided. Ironclad ships are now boxes containing a complicated mass of machinery, and comparatively but few men. First rate men-of-war used to cost 1,000*l.* per gun. Some late examples—the “Italia” for instance—cost something like 100,000*l.* per gun, and much more if we only count the big pieces able to pierce armour equal to that of their own ship. Fancy the value of 1,000,000*l.* going to the bottom as it may from the result of one blow, and then think how closely the Spirit of Artillery is following the same course as once resulted in the abolition of a degenerate chivalry, the excessive power of the strong over the weak, the rich over the poor.

We will now turn, if you please, to the examination of this spirit, and see how much we know about it, and how it is getting on with its growth.

And, first of all, what is its actual strength?

The difficulty of the subject, as treated from a philosophical point of view, has been illustrated by the extraordinary differences in the theoretical results arrived at by different investigators. Starting with the year 1702, De la Hire supposed that the force of fired gunpowder arose only from the expansion of the air lying within and between the grains, this expansion being caused by the heat developed in the action of combustion.

In 1743 Robins crushed this theory by showing that it would only account for about a 200th part of the force actually arrived at. Robins added the effect of the permanent gas developed from the powder which, raised by the heat, would give a force equal to 1,000 atmospheres.

Five-and-thirty years afterwards, in 1778, Dr. Hutton communicated to the Royal Society his researches on gunpowder, which showed a great advance over those of his predecessors. He calculated the force of fired gunpowder at about double the amount arrived at by Robins, and called it 2,000 atmospheres. But the laws of thermodynamics had not been discovered in his time, poor man, so his views are quite obsolete now.

Then, in 1797, Count Rumford attacked the subject again, and reported to the Royal Society a series of experiments in which he supposed himself to have proved that this tricky spirit of fired gunpowder, when kept tightly bottled up, was capable of exerting a force equal to the pressure of no less than 101,021 atmospheres, that is, 662 tons on every square inch.

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ought to be, and, indeed, in another place Gay-Lussac gives the amount as about 250 volumes.

Piobert himself, between 1831-36, gives various amounts, ranging from 200 to 650 volumes, but seems to have settled down to a theoretical estimate of about 350 volumes, with a maximum pressure of 23,000 atmospheres, that is, 151 tons at the time of greatest tension.

In 1843 General Cavalli (who, by-the-by, invented a breech-loading cannon) experimented with small barrels, and considered that with violent powders he obtained actual tensions of 24,000 atmospheres (158 tons to the square inch), while in less inflammable powders the force was under 4,000 atmospheres (26 tons).

In 1854 a Prussian Artillery Committee came to the conclusion that the actual maximum pressures were, in their 6-pr. guns, 1,100 atmospheres (7.2 tons per square inch), and in the 12-prs., 1,300 atmospheres (8.5 tons per square inch).

Between 1857 and 1859 Major Rodman of the United States made some important experiments with apparatus very similar to that which is chiefly used now on the Continent for taking pressures. He obtained results for tightly-packed powder varying between 4,900 and 12,400 atmospheres.

In 1857 Bunsen and Schischkoff published results which credited gunpowder with developing permanent gases which occupy 193 times the space of the powder.

And at last, in 1875, two gentlemen, before whose scientific authority on this question one stands cap in hand—Captain Noble, of Elswick, and Sir Frederick Abel—laid down, after a series of careful experiments, in which the new power—electricity—was called to their aid, that the tension of the products of combustion, when the powder fills entirely the space in which it is fired, is about 6,400 atmospheres, or 42 tons to the square inch, the temperature being about $2,200^{\circ}\text{C}$., that is, about $4,000^{\circ}\text{F}$.

Such has been the disagreement among philosophers who, however, doubtless approach nearer and nearer to the truth. What an inestimable comfort it would be could we stop here, and feel sure we are right. All these great philosophers gaily tripped up the heels of their predecessors, and who is to guard us against the advent of some new philosopher of distinction who will find flaws in the reasoning of Noble and Abel? Perhaps even a new science with a long name may be invented, as thermodynamics were. These two gentlemen are well able to take care of themselves in a controversy, but it was with positive sinking of heart that I observed some of their conclusions criticized and challenged by a French Committee appointed to examine them. And, alas! even our two philosophers show in a second memoir that the amount of permanent gas and the heat developed may be quite different in the different sorts of powder. They have even found that the maximum tension of some fired powders is so much as 44 tons on the square inch, and in actual practice results have been given by crusher gauges professing to show even higher pressure than this.

Let us accept a sort of rough round number for our practical

manufacturing purposes and call the maximum pressure of any ordinary gunpowder, fired in a space that it fills, 45 tons on the square inch. Then, if the powder-makers fulfilled the old desire to make the strongest possible powder, and if we suppose the interior of the gun, where the powder lies, divided into a number of rings, each an inch wide, we should have for a 12-inch powder-chamber a pressure of no less than 1,696·4 tons on each ring seeking to tear it open; in fact, to burst the gun. Now, this is just what we powder-makers would like, and the artillerymen would like, because tremendous pressures would, other things being equal, mean immense velocities for the shot and more honour to the craft. But at this point the gun-maker and the carriage-maker step in and tell us that neither gun nor carriage would stand such enormous strains for long. They say that this spirit must be tamed and kept within bounds lest it should work more harm to the gunners than to the enemy; and it will not do to reply that they can use less of the powder. No, they must have great effect and small pressure at the same time. The gun-makers are running a race, which appears to me rather dangerous, in their efforts to procure great effects from light guns. For, unfortunately, the same powder will produce different effects in different climates. English-made powder has been proved to give higher velocities and pressures in India than at home, and Indian-made powder is too weak here to produce the effect required. The spirit becomes more lively in a hot climate. This would matter little if the pressure allowed were at all near the high limit of the action of gunpowder. But in all new guns, English or foreign, the pressure must be kept at about a third of that which is possible, and it is a grave question whether on the whole it would not be better to strengthen the gun even at the expense of more weight. However, the progress which has lately been made has been chiefly in the direction of taming this terrible agent, and making it do its spiriting gently.

Let us try to conceive what happens in the powder-chamber of a gun when the charge is ignited. Here all is supposition, for we cannot possibly see the burning of the powder, and even the philosophical and important experiments of Noble and Abel only tell us the *results* obtained in burning very small charges, not how the results are caused, still less the process in a gun of high calibre. If we compare the heat of a small fire with that of a great furnace, we know very well that it differs not only in size but in intensity. Probably a similar difference, though not so great, exists between the combustion of small and large charges of gunpowder. For our purposes at this moment we will neglect these fine distinctions, and lump all the guns together. How then does a charge burn in a gun?

First of all a small flash darts from the outer world by means of the tube, through the vent, and fires the charge at one spot. The first powder ignited produces a small quantity of heated gas, which penetrates wherever the way is easiest, that is, round the cartridge and through any holes there may be in it. Then the lumps of powder, whatever shape they may be, begin to burn all over, producing a quantity of gas which is proportionate to the size of the surface

which is burning. In a single lump like that of the powder known as pebble, more gas is produced at first than later, because the burning surface is larger. Thus, supposing the usual theory is correct, namely, that each grain or lump burns regularly till all is consumed, we have much gas produced before the shot has time to start, and only a small increase afterwards to add to the velocity of the projectile, as it travels on through the gun. But if there be a hole through the lump as in the case of prismatic or the new cylindrical powder, it burns inside and outside at the same time, and, as the outer surface diminishes, the inner increases, so that we have an increase from the inside to compensate for the decrease of the outside, and thus the shot continues to receive a strong impulse up to the last, to quicken its speed through the bore. I shall show directly why I conceive that this theory is not altogether correct, but it is so up to a certain point.

With regard to the shape of the lump, it is clear that as nothing is stronger than its weakest part, lumps of a spherical or cubical shape will take a time to burn away equal to that of burning from the outside to the centre taken anywhere we like. But long or flat pieces will only require the time necessary to burn through half their smallest dimensions. It matters not how much powder there might be. A cake a foot square and half-an-inch thick would require no longer to burn than a small sphere half-an-inch in diameter.

But the charge in a gun is composed not of one lump but of many, and we have to ignite every one of them if we wish to obtain the full effect of the powder. The more regularly we can ignite the charge, the more regular must be its action, and the more regular the velocity given to the projectile. To this end it is necessary that the first fiery spirit produced should get at each lump quickly and all over its surface. Suppose that we light the charge from behind. I take this as the simplest case. A portion of the gas will rush round the outside of the charge through the space which surrounds it and another portion will rush into any spaces there may be between the lumps. Now in the old powders the lumps, or pebbles as they were then called, in the powders for heavy guns, lay irregularly throughout the whole charge. Roughly speaking, opposite each space where the gas would enter there would be a lump which, though ignited, would receive an impulse forward, or sideways, according to where the gas entered. It would be driven forward, a similar effect would be produced on others, and we might, as an extreme case, suppose a large portion of the charge propelled onwards and dashed in a mass against the base of the shot. There would be a sudden check, a blow on the gun as well as the shot, a recoil wave assisted by the gas from the mass which would now burn, and, altogether, a great and irregular dashing about of gas waves (probably liquid at first, but we will call it gas), and so may arise what are called wave pressures. These would be uncertain and incalculable, and the same charge might one day give one pressure on the interior of the gun and another day another pressure. The velocity of the shot would be different, and therefore the shooting irregular.

But now look at the back of a charge of prismatic powder. There

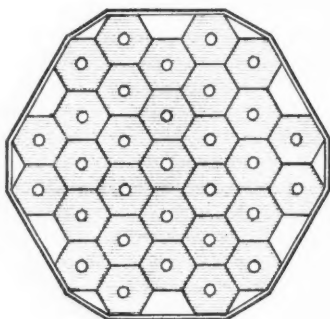
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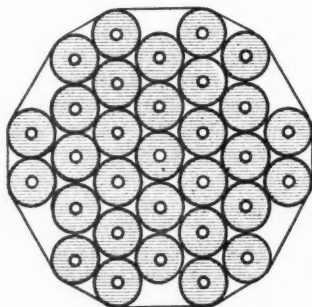
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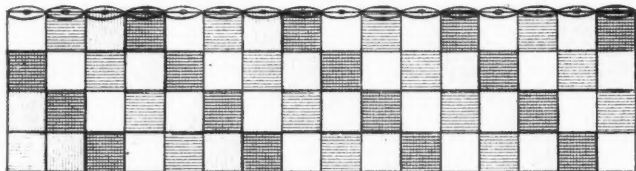
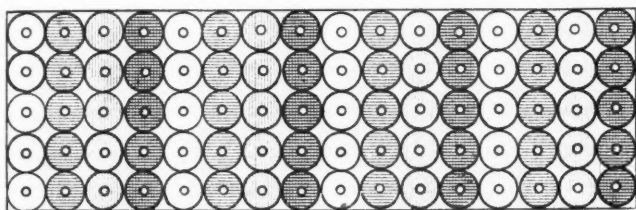
BASE OF CARTRIDGE MADE
WITH PRISMS.



BASE OF CARTRIDGE MADE
WITH CYLINDERS.



OF METHOD OF BLENDING 4 LOTS OF GUNPOWDER TO FORM ONE UNIFORM POWDER.



are regular holes running right through the charge from end to end, and giving easy access to every prism in its interior at least. In a charge of cylindrical powder, not only the inside but the outside of each cylinder is freely exposed to the passage of the heated gas, and, other things being equal, we may expect less irregularity of action, as turns out to be the case. You see that the theory is in favour of the cylindrical powder, and this is one of the reasons why I designed it in that shape.

But, whatever be the shape, it is impossible for the ignited pieces, pebbles, prisms, or cylinders, to remain in their places. How do they move and what do they do? This is just what I wish somebody would tell me. Perhaps they are at first prevented from touching each other by the liquid or gas which surrounds them. Perhaps, on the other hand, they are crushed almost at first. This is certain that in a bottle of fragments of prismatic powder blown out of a gun and picked up extinguished, I found one fragment showing distinctly that it was part of the inside of a prism, which inside had never been ignited at all. At any rate it seems highly improbable that the lumps of powder burn regularly as has been supposed. It is a little dangerous to differ from received theories, but there seems to be good reason for supposing that, at some point in the burning, the original lumps are broken up along lines of least resistance and, after that, the powder, being in many more fragments than at first, burns more rapidly and fiercely in its volcano of molten fire.

There are at least two reasons why it would appear probable that the lumps must break up. First, because each prism or cylinder, burning both from inside and outside, must become a mere shell hurried along among other such shells in a raging torrent of liquid fire, striking the sides of the bore and the other similar shells. Secondly, because hard as a piece of gunpowder may seem, it is really a sponge with extremely small orifices, into which I believe the gas at the great pressure which prevails must penetrate.

There are many facts with regard to gunpowder which can, so far as I know, be explained in no other way; and it is found that, acting on this belief as a theory, practical results always turn out much as was to be expected. For instance, if the surfaces at first ignited are large enough to get up a considerable pressure, yet not so small as that all the powder shall disappear suddenly, the size of each piece makes no practical difference, other things being equal. Here are two prisms very different in size which give almost identical results. I am not aware of a single case in which there has been among the pieces of powder blown out of a gun and afterwards picked up, one solitary morsel retaining the shape of a cylinder or prism regularly burnt from outside and inside. And, to crown all, I have actually seen pieces of powder break up into three or four morsels even when ignited in the open air of a room. If this seems a heresy, it is one which will, I believe, in time become an article of faith.

Before explaining the application of this theory, permit me just to mention the principal operations in the manufacture of the older powders.

1st. The three ingredients, Saltpetre, Sulphur, and Charcoal, in a state of fine division, are well mixed in a revolving drum. The English proportions are by weight in dry powder—

75 Saltpetre.
10 Sulphur.
15 Charcoal.

2nd. The mixture, in a moist state, is incorporated under stone or iron "runners," heavy wheels which revolve on a bed, for some hours, and so mix and crush the ingredients as to bring them into a sort of softish cake, in which they are amalgamated and can no longer be distinguished one from another.

3rd. The cake so produced is broken down into meal between metal rollers.

4th. The meal is pressed between metal plates into a harder cake of the required density.

5th. The new cake is broken up into grain between toothed metal rollers and sifted to the size required, or, in the case of the pebble powders, is cut into the masses which we know as pebbles.

There are other processes of dusting, glazing, &c., not worth describing; but a very important one is—

6th, Drying. Up to this point there is always a considerable amount of moisture in the powder, and it has to be expelled, so as to leave only about 1 per cent., for reasons which need not be stated here. But I ask your attention to one point: the particles of moisture have to make their way out of the powder and must do so by channels between the particles of powder. Thus the mass becomes more or less spongy. If the moisture is driven out rapidly, the orifices will be comparatively large and the mass more spongy; if slowly, the sponginess will be less. As extreme cases, I have, by rapid drying, for experiment, largely increased the size of the mass and even blistered it. By very slow drying the mass has actually contracted and become more dense than it was when moist. Ignited in the open air, the fast dried pieces will burst like crackers, the slowly dried will burn slowly.

In order to get rid of the difficulty and the time spent in drying, we have tried making the grain of such a moisture only as will, when pressed, give a powder which requires no drying; and we have had considerable success with it. The best result yet given by a black powder in the 6-inch B.L. gun was obtained with a "dry-grain" powder, called—

	M.V.	Pressure.	Date.
Ls.....	1,963 f.s.	16.4 tons	25.10.82
Later, cocoa powder gave..	1,974 "	16.3 "	5.6.83
Still later ,, ..	1,945 "	14.2 "	7.9.83

The newer powders, prismatic and cylindrical, pass through the same processes as the old until after granulation. The granulated powder is then simply pressed in moulds and dried. There are no other processes of manufacture, but a very important process of arrangement called "blending," of which more will be said shortly.

The process of pressing the grain into moulds came to England

from America, was rather neglected here, but taken up in Russia, where the prismatic powder was first produced. The good qualities of prismatic powder were brought prominently into notice during the competition between the Armstrong and Krupp 9-inch guns at the Tegel practice ground, near Berlin; but even then it was not adopted here, mainly, I think, because the Russo-Prussian powder was, in its details, more suitable for breech-loading than for muzzle-loading guns. With details a little altered, it is now found much superior to pebble powder for even muzzle-loading guns. It was introduced at Waltham Abbey, on the recommendation of the Explosives Committee, in 1880. Besides the quality already explained of burning with better late effects, it is more regular, and has the advantage of making up into a better cartridge than the irregular lumps called pebble powder.

This prismatic powder was, therefore, a decided step in advance, but further progress was required. Hitherto short muzzle-loading guns had been used in this country, though Sir William Armstrong had produced long guns and proved their value as early as 1878, showing at the same time that breech-loaders and muzzle-loaders, made of the same internal dimensions and using similar ammunition, produce exactly the same effect. A high velocity with low maximum pressure on the gun was obtained by enlarging the powder-chamber, so as to leave an air-space. This was the best that could be done with the old powders, but Noble and Abel had already, in their second report to the Royal Society,¹ pointed out that, by detaining the projectile by a strongly resisting band, more value could be got out of the powder before the shot moved. Then the question arose whether a very slow-burning powder could not be used in this way to advantage by employing large charges which, burning slowly at first, would give little pressure, but would continue to develop a large amount of gas as long as the shot remained in the bore. In fact, the problem was to obtain the lowest attainable pressures at the breech and the highest at the muzzle. Colonel Maitland, the Superintendent of the Royal Gun Factories, asked if we at Waltham Abbey could break in the Spirit of Artillery to do this work, and we began to try our hands. I believe that this was the first instance, at least in England, when gun-maker and powder-maker agreed to work together, without the intervention of a Committee, and it was a recognition of gunpowder as the Spirit of Artillery, which must in time become universal.

The idea upon which I commenced work was, to use a shape which would be practically easy to make, would stand more rough usage than the angular prismatic powder, and would be ignited as regularly and uniformly as possible inside and out. As a first step, the angles were taken off the hexagonal prism so as to give it twelve sides. The result seemed promising, and the second step was to the cylindrical form. At the same time experiments were carried out to ascertain what was the greatest density which could be given to powder of the usual ingredients within fairly easy manufacturing limits. We found that 1·9 was almost more than we could do, and finally settled down to about 1·88. The first cylindrical powder made was of about the same

¹ "Researches on Explosives, No. II. Fired Gunpowder," pp. 242-43.

size as Waltham Abbey prismatic powder; but as this required a long time to dry, we reached at a later period the size now before you, which has been adopted into the Service and is called C_2 . Shortly after the larger-sized cylindrical powder had been made, the Ordnance Committee commenced their labours, and the powder was laid before them for trial. The trials have lasted a good deal longer than was pleasant to us impatient manufacturers at Waltham Abbey, but in the end the powder has been adopted, with the full approval of the Committee, and is now being manufactured for the Service. The chambers of all the new heavy breech-loading guns have been designed to fire this powder, on the same principle that makes men buy a saddle and bridle to fit the horse, not a horse to fit the saddle and bridle. The Spirit of Artillery has been given its fitting place, and the results are what you see on the table.

So far we have dealt only with the manufacture of powder with the usual materials in the usual proportions, but there is much to be done in modification of these. I happened once to be travelling in the same railway carriage with Sir W. Armstrong, and he asked whether, in view of getting rid of the eating away of the bores of guns by our unquiet spirit—erosion, as this “eating” is called—something might not be done by reducing the proportion of sulphur. On thinking over the question, it occurred to me that such a change might be advantageous in producing the slower powders now required. A few small experiments gave promising results, but the proposal found little favour, and it was left to a German firm to produce afterwards an excellent powder by this means and by the adoption of our new densities. This is the powder (Construction 82) the results of which are shown on the table. (See Table.) The composition of the powder is the same as that of the ordinary German prismatic, except in the proportion of the ingredients. The density is greater.

Another powder has been introduced in Germany, and is made there by two firms. It is called Cocoa Powder by one, and Brown Powder by the other. The proportion of sulphur is again small, and the charcoal, if so we may call it, is different from that generally made. It was only brought forward last year, and was at first irregular in action, but later samples have given very good results—about the same as Waltham Abbey C_2 , and with a less amount of powder, which is an advantage. As it is supposed to be a great secret we must be silent about its details here, further than to say that we are able to make it at Waltham Abbey if its value is established. There are very different opinions about it: some people saying that it is too destructive to the interior of guns—in other words, that there is too much erosion. But it has two advantages over ordinary black powder, which, in my opinion, give it great claims to acceptance. It gives little smoke compared with black powder, and burns slowly in the open air, so that its manufacture is less dangerous. It contains more hydrogen, and produces, I believe, more permanent gas when fired in a confined space. There is reason to believe that it may be valuable in the old muzzle-loading guns as well as in the new breech-loaders.

Here is another powder, invented by the Italians, and called Fossano Powder, from the place where it is made. It is like our old P_2 powder, but larger, and the cake is differently made. First, a comparatively thin cake is made out of dense-grained powder; then this cake is again pressed between layers of lighter powder, and then the compound cake is broken up into lumps. The theory is that the outer layers will burn or break up first, and leave the denser grained interior to continue the action up to the muzzle of the gun. I venture to think that, though this was an improvement on the old powder, it will be superseded by the newer. Here are the results of some experiments lately made in the 100-ton Armstrong breech-loaders. They were carried out at Spezia by the Italian Committee. (See Table.) You will observe that the Waltham Abbey C_2 powder gave better ballistic results in the 43-ton B.L. gun than the cocoa powders, and we should expect even a greater difference in higher calibres. But the cocoa and brown powders have both beaten the Fossano powder. Still more would the C_2 be superior in ballistic effect.

A very wide field of progress has been opened by the use of grained powder pressed in moulds. The Spirit of Artillery has been bridled as it never was before, and rendered much more manageable. If we take a light-grained powder and press it together into a dense mass, we obtain lumps, of whatever shape, which will burn steadily for short muzzle-loaders. But if we take a powder of dense grain to begin with, and press it only so much as to make it hold together when first burning, but break up easily afterwards, we obtain in the later stages of combustion small pieces which will continue the production of gas as long as the projectile is in the gun. By this adjustment of means to the end we can meet any of the practical conditions which govern the dimensions of ordnance with reference to the places where the guns have to be worked.

And now, with reference to the blending. An idea has lately been afloat that this process (which consists in mixing powders which, after manufacture, are found on proof to differ to some extent in results) can be got rid of, and powder made so regular that it will need no blending. No one can say what the future may bring, but up to this time there appears no prospect of any such consummation. You all know that there are people, and even plants, so organized that every change of weather affects them. This is precisely the case with the spirit we are imprisoning in gunpowder. It is such a nervous and sensitive spirit, that in almost every process of bottling it up—that is, in the manufacture of gunpowder—it changes under our hands as the weather changes. Sometimes we can detect its nervous sensibility and allow for it, as in the process of pressing into moulds, when we can by actual trial tell what densities we are getting, and give more or less pressure as is required. For instance, on the morning of the 13th June, 1882, the pressure had to be applied for 45 seconds to obtain the required density. Later in the day only 29 seconds were required to obtain the same density. So that in the morning of a June day half as much again time was required as in the afternoon. On the 30th June, 1882, during part of the day the time was

as short as 26 seconds; on the 11th December the time varied between 98 and 84 seconds to produce the same density as was obtained in June with 26 seconds. That is nearly four times as long in the one case as in the other. In other stages of manufacture we have no such indications; but it is a fact that, not only the warmth of summer and the cold of winter affect it greatly, but the morning mists, the sunshine of mid-day, the dews of evening, nay, even a passing cloud, tell upon its nervous temperament. As a mitigation of the weather difficulty we are about to try warming a set of houses with hot water. By this means we hope to obtain a little more regularity, but it will not meet all the difficulties. The state of the weather during the process of drying is especially important, and as we dry 100 barrels or cases at a time, each "lot," as it is called, differs from other lots, as one child in a family differs from others; we know not why. So then, if we want uniformity of energy, we must put our children together in batches or teams like horses, putting the weak with the strong, so as to produce an average power and effect.

In the old powders the selected lots were put together and mixed in revolving barrels. But it is conceivable that when finished and subjected to that perpetual motion which is the fate of all things military belonging to England, there may occur in the shaking during a series of years a change of position in which the larger grains will come to the top and the smaller grains sink to the bottom, so that a charge taken out of the top of a barrel may give different results from one taken from the bottom. With the new powders there is no such danger. At Waltham Abbey we blend them with the greatest accuracy, as you see in the diagram, and they cannot shift their places, because their shape will not let them. (See Diagram.)

There is one feature in the manufacture of gunpowder to which I have not referred, as it is only an assistant, and does not in any way influence the character of the powder. I was amused at seeing a paragraph in a scientific paper the other day asserting that a certain gunpowder factory has just been provided with the electric light, and this was the first use of the light for such a purpose. We have had it at Waltham Abbey for two or three years past, and my ingenious friend, Major Watkin, has designed what I believe to be the safest possible light in existence. It may interest some of you to examine the arrangement with him presently. In the meantime I think you will admit its absolute safety. The incandescent lamp—anybody's will do—is plunged in a large glass vessel of water and hermetically sealed. The light can be used where we should fear to have any other known light, and thus are secured at once longer working for several houses, and brilliant illumination with perfect safety.

We have now run over the principal changes which have lately occurred in the manufacture of gunpowder—the production and breaking in of the Spirit of Artillery. And it all comes to this, that every step has opened up fresh possibilities, so that I, for one, feel that we are as yet only on the threshold of an immense subject. I forbear to lead you forward out of the region of facts into that of speculation.

But, certainly, much remains to be done. The force which abolished the shams of the old decaying chivalry has, by its influence on arms, called forth a larger chivalry, in which the private soldier may become and be recognized as a hero. It demands from him a courage capable of sustaining him in danger when there is no shock of battle to stir him, but a long waiting under a rain of death which comes to him from afar—unannounced, invisible. It demands also from him education and intelligence, not merely brute force. Whether, after having created the call for ironclads, it will abolish them again, remains for time to show; but if England keeps, as we all believe she will, her place in the first rank of human progress in arts, arms, and in the lofty courage which flourishes only where true liberty exists, we can only welcome the progress of the Spirit of Artillery.

TABLE I.—*Philosophers' Calculations.*

Date.	Authority.	Volume of gas.	Pressure.		Heat evolved. C.	
			Atmospheres.	Tons.		
1743	Robins.....	244	1,000	6·7	°	
1778	Hutton.....	250	2,000	13·5		
1797	Rumford.....	..	101,021	662		
1823	Gay-Lussac....	450	2,137	14·3	1,000	
1831-6	Piobert.....	350	23,000	151		
1843	Cavalli.....	..	24,000	158	..	Violent powders.
			4,000	26	..	Less inflammable powders.
1854	Prussian Artillery Committee	..	1,100	7·2	..	In 6-pr. gun.
			1,300	8·5	..	„ 12-pr. gun.
1857-9	Rodman.....	..	From 4,900	32·1		
			To 12,400	81·3		
1857	Bunsen and Schischkoff	193	4,374	29	3,340	
1875	Noble and Abel	280	6,400	42	2,200	

TABLE II.—*Performances of different Guns and Gunpowders.*¹

Gun.			Powder.		Shot.	Muzzle velocity.	Muzzle energy.	Mean pressure.	
Calibre.	Weight.	Loading.	Nature.	Weight.					
ins.	tons.			lbs.	lbs.	ft. secs.	ft. tons.	tons.	
8·12	4·75	M	L.G.	16	66	1,580	1,142	..	68-pr. S.B.
7	4·1	B	R.L.G.	11	90	1,165	846	..	100-pr.

¹ The object sought is to obtain the highest muzzle velocity with the lowest pressure.

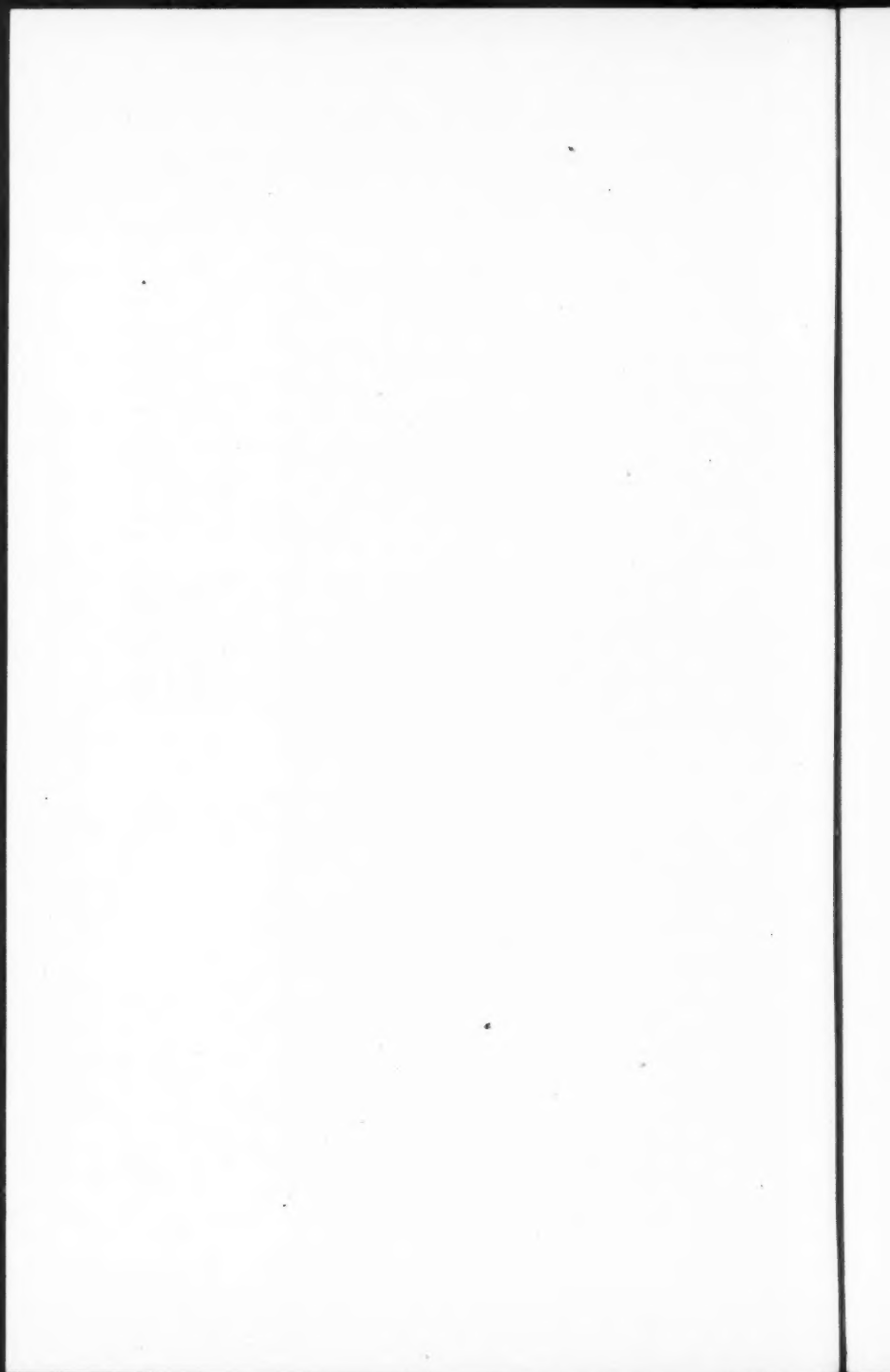
Gun.			Powder.		Shot.	Muzzle velocity.	Muzzle energy.	Mean pressure.	
Calibre.	Weight.	Loading.	Nature.	Weight.	Weight.				
ins. 9	tons. 12	M	P.	lbs. 50	lbs. 253	ft.secs. 1,420	ft.tons. 3,607	tons.	
10	18	"	"	70	410	1,364	5,288		
12	35	"	P ²	140	714	1,390	9,125		
12·5	38	"	"	160	818	1,445	11,842	..	Unchambered.
"	"	"	C/82	210	"	1,591	14,352	16·7	
"	"	"	Prism.	"	"	1,615	14,790	19·0	
16	80	"	"	450	1,700	1,604	30,329		
17·72	100	"	"	"	2,000	1,548	33,233		
"	"	"	Fossano.	551	"	1,706	40,000	20·0	
9·2	18	B	C/82	150	320	1,976	8,661	15·1	
"	"	"	C ²	200	"	2,075	9,551	15·0	
"	"	"	Prism.	150	"	1,960	8,521	16·5	
"	"	"	Brn. "	160	"	2,011	8,971	15·4	
10·4	26	"	C/82	220	462	2,001	12,823	15·9	
"	"	"	Prism.	205	"	1,868	11,175	15·6	
"	"	"	Brn. "	220	"	1,923	11,843	15·2	
12	43	"	C ²	350	714	1,996	19,719	16·3	
"	"	"	"	340	"	1,910	18,056	13·8	
"	"	"	Prism.	260	"	1,770	15,506	15·0	
"	"	"	Brn. "	300	"	1,978	19,365	17·4	
17	100	"	Fossano.	772	2,002	1,833	46,620	16·5	
"	"	"	Düneberg	"	"	1,841	47,036	14·6	
"	"	"	Brn. prism.	"	"	"	"	"	
"	"	"	Cologne	"	"	1,795	44,715	13·3	
"	"	"	Brn. prism.	"	"	"	"	"	

Mr. KRAFTMEIER: Colonel Brackenbury in his lecture seems to have a strong preference for the larger prisms and larger cylinders. Now he mentions that, in drying out the moisture, small channels are formed in the prisms. Of course, in constructing larger prisms and larger cylinders there is much more moisture to be driven out, and therefore I should think there is much more chance of irregularity in the larger prisms by a larger quantity of channels being formed, and I should think that this would rather destroy the regularity which is expected to be attained from the more regular form and process of combustion of these larger cylinders. I have quite recently received news from Spezia that the 100-ton Armstrong breech-loading gun has also been fired with a charge of 375 kilos. of brown prismatic powder—about 825 lbs.—and that the pressure has not been very much higher than with the 350 lb. charge. I am sorry that I have not the actual results here.

Colonel BRACKENBURY: Mr. Kraftmeier, I think, has not quite understood me,

when he says that I strongly advocate any particular size of gunpowder ; on the contrary, I think I am about the only person in Christendom who says it does not matter one way or another for ballistic purposes what the size of the powder is, or scarcely at all. I am perfectly prepared to accept either size, and will engage to get by other manipulations of the powder almost identical results, whatever the size may be, within reasonable limits. Drying the cylindrical powder takes a very much shorter time now than it used to do, and not only so, but by a process which we are working out, we shall, I believe, get rid of drying altogether. Drying has been looked upon as a process in the manufacture of gunpowder which has given the utmost trouble, and has altered the constitution and effects of powder to a very large extent ; but by the process which we see our way to adopting, when we have worked out the details thoroughly, we shall get rid entirely of this troublesome process. I have had no information with regard to the experiment which Mr. Kraftmeier mentions as having taken place at Spezia ; but I may say that some of the results at Spezia, shown on the table which hangs before you, were kindly communicated to me by him as agent of one of the great German firms, and the other results by the other agents. I may also say, and I am very glad to acknowledge it, that we are indebted to German manufacturers of gunpowder for having brought to the notice of this country the prismatic powder which they have worked out with a great deal of trouble, and also for kindly communicating to me on more than one occasion details which I was very glad to have. I have to thank Mr. Kraftmeier and the firm he represents for having given me valuable information on very important questions.

The CHAIRMAN : I have only one more duty to perform in reference to this lecture, and that is to ask you to thank Colonel Brackenbury most cordially for having brought this subject before us. It is manifest it is one of considerable intricacy, and, as he says, he, with all the knowledge he has brought before you, is only on the threshold of it, I think we may look forward to further lectures in this theatre ; and I hope, perhaps, Colonel Brackenbury himself, when he has passed the gateway of which he is only on the threshold, will be able at some future time to follow up the subject. I beg to offer, in the name of the meeting, our cordial thanks to Colonel Brackenbury for the lecture he has given us.



Friday, May 16, 1884.

MAJOR-GENERAL SIR FREDERIC J. GOLDSMID, K.C.S.I., C.B.,
in the Chair.

RUSSIA'S APPROACHES TO INDIA.

By Lieut.-General Sir EDWARD HAMLEY, K.C.B., K.C.M.G., &c., &c.

In December, 1878, I had the honour to deliver a lecture in this room on the "North-west Frontier of India," with special relation to the attitude of Russia. If the subject admits of fresh treatment, and attracts increased interest at the present time, it is because of certain recent changes in the conditions of it, such as it is my object on the present occasion to set forth. And I will begin by recalling to mind what aspect that very essential part of the question, the attitude of Russia, bore at that time.

Probably England has never been quite free, during the present century, from some degree of anxiety caused by the steady gradual approaches of Russia through Central Asia towards India. It was seen that where her foot was planted it never went back. It was seen that with forces comparatively small she never failed to effect any conquest she was bent on, and that the conquest, once effected, was final. This security in possession was owing in great measure to the fact that the governments she displaced were bad governments, and that she substituted one far better in itself, and of a simplicity which was well adapted to the people with whom she was dealing. She aimed mainly at three things—the establishment of order and of confidence, and the obtaining of some return for her own heavy expenses. From the establishment of order and of confidence sprang a prosperity which enabled her to obtain a certain revenue, though entirely inadequate to her expenditure. Thus we beheld her pressing solidly on, and we knew not where she might stop. Pretexts, such as it was difficult to find a flaw in, were never wanting on which to ground a fresh absorption of territory. And seeing behind this advance a vast country, almost a continent, which was not merely a great Asiatic Power, but a great European State, under autocratic irresponsible rule, with interests touching ours at many points, it is

not to be wondered at that we watched with anxiety her progress as she bore steadily down towards our Indian frontier.

In 1867 the Central Asian conquests, which had then consolidated themselves behind the Jaxartes as their frontier, and which had been hitherto part of the Government of Orenburg, were made independent of all but the Imperial Government, and became an integral part of the Russian Empire, as Turkestan. In this fact might be read new facilities for aggression, and increased means of making this territory a solid base for further military advances; and a greatly increased jealousy of Russia dates from this period.

In 1873 the Governor-General, Kaufmann, conquered and annexed Khiva, pushing the frontier forward to the Oxus.

But it was in 1878, when our difficulties with Shere Ali and Afghanistan were imminent, that this jealousy and this anxiety first took palpable form. While the Treaty of Berlin was still pending, and while the prospect of a settlement of the claims of Russia upon vanquished Turkey was still doubtful, Kaufmann assembled a small army on the frontier of Bokhara with the design of marching it upon Afghanistan. It consisted of about 12,000 combatants of all arms, and thirty-two guns. Its line of advance was to be southward on Balkh, whence two routes converge on Cabul. And though such a force as that resembles no more than an advanced guard in comparison with an army capable of disputing with us the Empire of India, yet I leave you to imagine what effect the presence of this corps at Cabul might have exercised on the campaigns of Stewart and Roberts in Afghanistan. However, the Treaty of Berlin was signed, and the corps never advanced; but its assembly had for us at least this good effect, that it put vague menaces into a tangible form, and taught us what might be in the possibilities of the future.

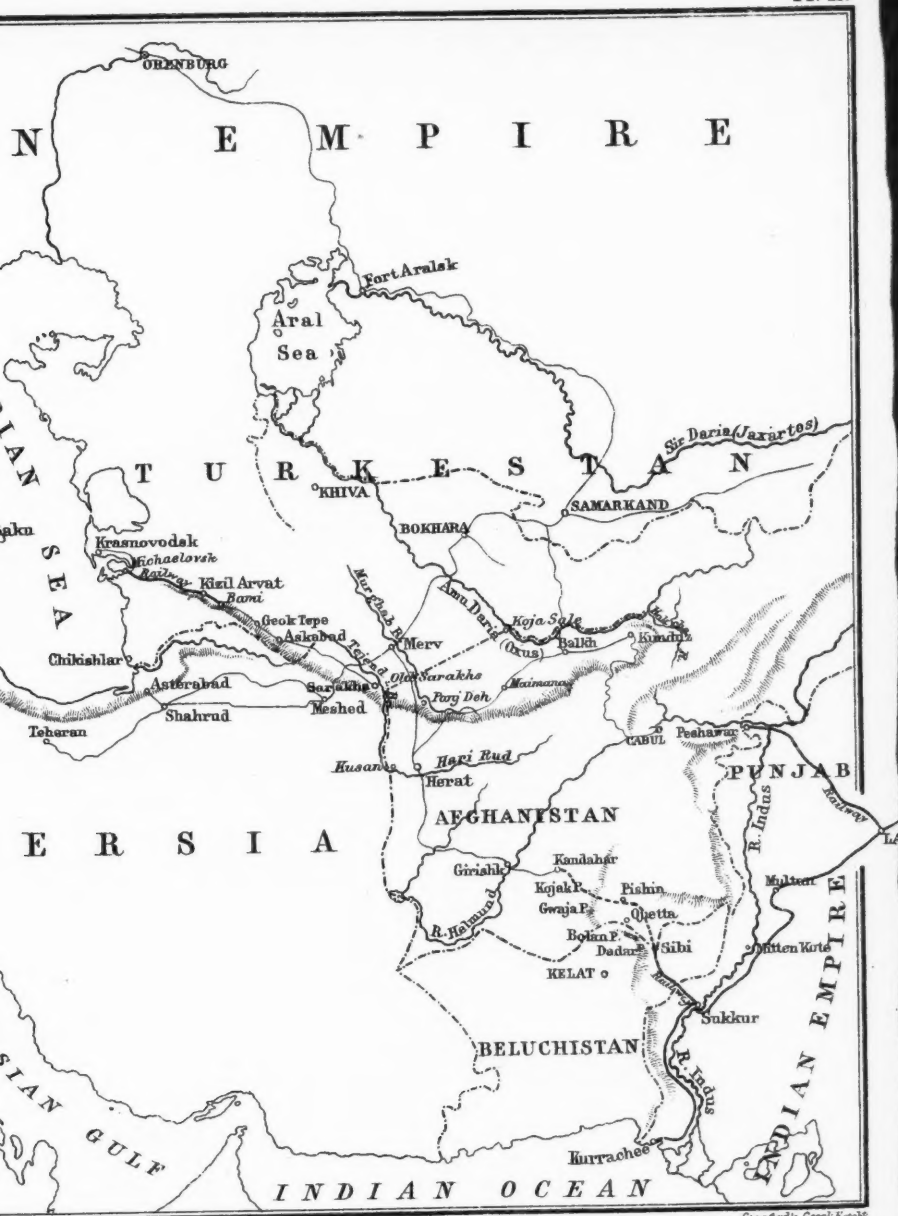
Now it is a curious fact that in the preceding year, that remarkable soldier Skobelev had written a paper on the invasion of India from Turkestan (where he then held an important command) setting forth the ideas embodied afterwards by Kaufmann. Asserting that Turkestan is "a perfectly secure base of operations," he goes on to talk of "that terrible offensive power which we possess in Central Asia," and points to the mode of employing it against us in the march of such an army as Kaufmann's to the Afghan frontier.

I wish to draw special attention to the fact that, though far-seeing people had already cast glances elsewhere, the point of the compass to which we looked from our Indian frontier in expectation of a gathering storm was northward, where lay Turkestan. Now between Herat and Turkestan lay the territory of Merv, hitherto unannexed, and inhabited by warlike tribes of Turcomans, difficult to reach through their deserts, and likely to harass a Russian advance to a degree greatly embarrassing. Merv, then, gave us at that time a certain security, but how long this barrier might be maintained was very doubtful. After the fall of Khiva wild rumours spread in Afghanistan and the Punjab that the conquerors were forthwith to overrun Merv. It was seen that the possession of this territory would at once free Russia from much difficulty in case of an

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advance, and give her the means of threatening Herat, as well as Cabul, from her base in Turkestan, and even, to some extent, to carry forward that base beyond the Oxus. And therefore, while our attention was still mainly attracted northward, the prospect of seeing the Russians in Merv was already a source of often expressed anxiety.

There is a piece of quasi-independent territory, Bokhara, which, as the direct roads from Samarcand to Balkh and to Merv lie through it, must be considered. Large slices of it, including its capital, have already been absorbed, and one fact alone is needed to show its dependence on Russia, apart from other overwhelming influences, namely, that by a dam which they have constructed on the river near Samarcand they control the system of irrigation, without which much of the cultivated territory of Bokhara would revert to the desert. When Kaufmann was organizing his corps of invasion of Afghanistan in 1878, he sent a diplomatic agent to the Ameer of Bokhara to secure his co-operation, and to explain that, owing to the position of political affairs, it would be necessary for the forces of Russia to march to the upper part of the Oxus. The agent represented also that the Governor-General relied on the friendly feeling already shown by the Ameer during the march to Khiva for assistance in collecting supplies for his army. The Ameer, not without some natural reluctance at the prospect of seeing Bokhara occupied by Russian troops, finally promised to fulfil the Governor-General's wishes, and gave all assistance in his power to the Russians, furnishing them with food and forage, and promising to supply posts for the telegraph wire, which the Russian Government intended to prolong from Samarcand to the Oxus. It is evident therefore that the annexation of Bokhara, believed to be only postponed during the life of the present Ameer, will make but small difference so far as the control of the country for military purposes is concerned.

Circumstances tending somewhat to reassure us always existed in Central Asia. Between Turkestan and Russia lay sandy deserts and uninhabited steppes, the passage of which was so difficult that it took two years to move soldiers from the Volga by Orenburg and Fort Aralsk to the district of Turkestan. Having thus only long-stretched links of communication in the rear, an advance from the province towards India was also beset with difficulties, in lofty ranges and rugged passes. Thus, despite her recent threat, it was seen that a great enterprise against us must be very difficult of execution, and such as could not be lightly undertaken.

During some years after the annexation of Khiva, the strength of the Army of Turkestan may be taken as about 35,000 men, and seventy or eighty guns. The Army of the Caucasus was exactly five times as strong in men and guns, yet, viewed from the Indian standpoint, it attracted comparatively small attention. For this there were many good reasons. In that quarter lies the wide expanse of the Caspian, spreading 700 miles one way by about 200 across its narrowest part. In a fertile and populous country such an inland sea would in all ages have been covered with ships bearing freights from

side to side in innumerable tracks, and supporting maritime communities along its margin. But, down to a very few years ago, while Russian policy had banished the Persian flag from its ports on its own (the southern) frontier, the other three sides, in Russian territory, barren even of fresh water, were dotted, on the Eastern shore, only with military posts. Bare, desolate, and windswept, bordered by wide shallows, and destitute of good landing places, its waters, traversed only by a few small Russian ships of war and trading vessels, were an obstacle rather than a highway. The earth can hardly afford a more dreary outlook than is offered to one standing on the shore of that solitary sea. The communications with it were difficult and incomplete. Railways exist from the great towns of Russia to the Volga, itself a great highway, but for five months in the year that river, and the North Caspian also, are closed to navigation by frost. The railway from Poti on the Black Sea to Tiflis, the capital of the Caucasus, was opened in 1874; but its continuation from that city to the Caspian was as yet only a project. But the grand obstacle lay in the nature of the country and its populations east of the Caspian. The whole region stretching from the northern extremity of its eastern shore up to and along the Oxus, and from the southern extremity along the Persian frontier, may be described as a vast desert everywhere, except along the tracks of rivers which, owing, doubtless, to the flatness of the surface and the nature of the soil, spread themselves out and find their end in barren swamps. Thus, the strip watered by the streams which descend from the frontier of Khorassan is known as the Akhal Oasis—the lands which receive the last flow of the Hari Rood, after it has run by the Valley of Herat into the vast plain, are called the Tejend Oasis—while the Moorghab, pouring down from the Afghan frontier forms (ere it disappears in the sands) the Oasis of Merv. But elsewhere, along the southern bank of the Oxus, from thence past the Aral Sea to the Caspian, and along the eastern shore of that sea to the Persian frontier, lies a belt of horrible desolation, nowhere less than 150 miles wide, where the terrors of heat and thirst are assuaged only at long intervals by wells of scarcely drinkable water.

And if the aspect of the country was in the highest degree repellent, so also was that of its populations. Different tribes of Turcomans inhabited the different Oases, which they cultivated only so far, often not so far, as was necessary for the subsistence of themselves and their horses. Beyond this scanty agriculture they lived entirely by manstealing and plunder. They were the terror of the caravans, of travellers, of all persons in neighbouring territories living within reach of their forays. Confiding in the inaccessibility of their haunts, they defied all rule and law, and up to the year of Skobelev's campaign against them, they carried their depredations up to the very shores of the Caspian.

In 1877 attention was for a time attracted to the side of the Caspian by an expedition which General Lomakin made from Krasnovodsk across the desert, consisting of about 5,000 men and six guns, to Kizil Arvat, with a view of there erecting a fort for the protection of

caravans passing between Khiva and Krasnovodsk. In May of that year, after reaching his point, he defeated the Turcomans; but early in August, finding his provisions fail, and learning that the tribes were organizing an attack on his communications in the desert, he retreated with his force to Krasnovodsk without effecting anything more.

This advance was looked on by the Government of India as foreshadowing the occupation of Merv, and was made the subject of strong recommendations to the Home Government, which did not, however, attach the same importance to it, but was inclined to accept the motive assigned for the movement by the Russian Minister, namely, the necessity of chastising the Turcomans.

In 1878 the advance on the Oasis was repeated by Lomakin, this time not from Krasnovodsk, but from Tchikishlar, in the south-eastern corner of the Caspian. From thence depôts were formed along the Lower Attrek. It was originally intended that the force should follow the Persian frontier sufficiently far to enable it to debouch on the flank of the Turcomans. This being found impracticable, the expedition struck northward across the desert, but without attaining even so much success as that of the preceding year, for it retreated to the Caspian before reaching the Oasis.

In 1879 the region was the scene of a third campaign, and the base was again Tchikishlar. The force was much more formidable, being nearly 20,000 strong, and was concentrated on the Attrek, 120 miles from Tchikishlar, in August. Before it advanced its commander, General Lazareff, who had gained distinction as a General in Armenia, died, and was succeeded by Lomakin, the same who had directed former operations. It succeeded in concentrating before the Turcoman fortress of Geok Tépé in September, but suffered a heavy defeat in the attempt to assault it. Thereupon the Russians once more retreated, but it was not till the end of December that their last troops reached the western shore of the Caspian.

Such, then, is a statement of the position as it existed up to the date of my former lecture. It will be seen that those who persistently denied, as a whole class of politicians did, that our Indian Empire was threatened by Russia's augmenting acquisitions, had this plea on their side, that great difficulties lay in the way, and that to give effect to menaces would be an arduous and dangerous enterprise, ill success in which might even shake the whole fabric of Russian power in Central Asia. But it must also be admitted that the changes which, within a very brief space, have since occurred, and which I am about to point out, have been so startling that these cheerful utterances have no longer the same validity, and that those formerly branded as alarmists may claim that the steps in Russia's advance, and her increased facilities for aggression, have even gone far beyond their prognostications.

This change dates from 1880. In that year Skobelev was commissioned to repair the failure of the preceding year, and to restore whatever authority was then endangered, by a fresh advance against the Tekke Turcomans on the other side of the Transcaspian desert.

His design, like that of preceding Generals, was ostensibly this: to inflict a blow on the Turcomans such as should drive them far back and prevent them from in future harassing the communications between Turkestan and the troops on the Caspian, which he intended to improve by a route from the western border of the Tekke Oasis to Khiva. That such a route might be made, and would be in all respects better than that already connecting the Aral with the Caspian, was presently demonstrated by the march of a small contingent from the neighbourhood of Khiva, which joined him at Kizil Arvat in excellent condition. The first thing he did was to conduct a small manageable force along the route from the Attrek to the Akhal Oasis at Bami, about 180 miles from the Caspian, and about 80 from the Turcoman fortress of Geok Tépé. Having seized his point and secured it by intrenchments (the enemy retiring to their stronghold), he proceeded to create there a base for future operations. Resisting all incitements to a premature advance, he spent the interval patiently, from July to December, in accumulating supplies for a force of 10,000 men for six months. These stores came from the Volga, from the Caucasus, and from Persia, and were conveyed by camel trains across the desert between Krasnovodsk and the army. When the supplies were complete, the troops were concentrated on a point further on, and in January, 1881, the final advance was made, when the fortress was besieged and stormed; and, soon after, a detachment was pushed forward to Askabad. That place was strongly occupied, and perfect tranquillity thenceforward prevailed in the Transcaspian territory, which was annexed by Imperial ukase in May, 1881.

Now was seen the full import of the new advance, hitherto not fully appreciated perhaps even by Skobelev. During his operations, a railway, the materials for which, intended for the army of the Danube, had been lying idle in Southern Russia, started from Michaelovsk on the Caspian, and was following in his track. It was completed in 1881 to Kizil Arvat, 144 miles from the Caspian.

Now the Caspian itself had, down to recent times, been an obstacle to transport. But Baku, on its Caucasian shore, where there is a natural harbour improved by art, had lately sprung into importance as a port. It has always been known that the soil of the surrounding district, to a great distance, was deeply impregnated with naphtha. In ancient times, the flames spontaneously rising and for ever burning amid the surrounding rocks, were regarded as something supernatural and divine. The sect of Guebres, or fire-worshippers, looked on it as a region of peculiar sanctity. The oil bubbling from its reservoirs beneath the Caspian spread itself over the sea, and to see it set on fire was one of the marvels shown to travellers. Of late, since certain Government prohibitions have been removed, the trade in this oil has grown to important dimensions. Baku has become a considerable city; its harbour is filled with steamers, the vessels belonging to the port of Baku alone being numbered by the hundred; but we need not concern ourselves further with the statistics of the matter, since the means of conveyance across the sea far exceed those of the rail-

way on the other side. And it is a remarkable piece of good fortune that the residue, after the oil is made, is perfectly serviceable for burning in locomotives, and the railway is thus amply supplied with fuel on the spot.

At the end of 1882 the railway of the Caucasus was continued from Tiflis to Baku, with a branch to Batoum, a more convenient and healthy port than Poti.

Now I ask you to contrast the difficult and precarious route from the Volga to Turkestan, such as I have described it, with the new route through the Caucasus. From Odessa troops can be conveyed across the Black Sea to Batoum in two days, from thence by rail to Baku in twenty-four hours, another twenty-four hours would see them landed at Krasnovodsk, transferred in lighters through the shallow water to Michaelovsk, and the entrainment of them begun, when the journey to Kizil Arvat, the present though by no means the final terminus of the Transcaspian line, occupies twelve hours.

The communication with Odessa of course admits of the reinforcement of the Caucasian army to any extent. But the Caucasus itself forms an effectively independent territory for beginning a campaign. It is no wild barbarous region, but a country rich, well-watered, and now thoroughly Russian, and its capital, Tiflis, in the advantages of its site and climate, its size and importance, its public and private buildings, and its establishments as the headquarters of an army, may stand comparison with nearly any city in the Czar's dominions. The war strength of the army of the Caucasus is 160,000 men.

The efficacy of the other channel of communication between Russia and the Caspian has also been largely increased of late years. Besides four lines of railway to points on the Volga, complete communication between the Neva and that river is afforded by the canal system of the country. And to obviate the interruption occurring in the winter months, a line of railway is projected from a point where many lines from Russia converge, in Cis-Caucasia, to Petrovsk on the Caspian, and thence along its shore to Baku. You will therefore probably agree that there is not at present much difficulty, and that such as there is will shortly disappear, either in bringing reserves and stores, to any extent, on the lines from Northern Russia, and also from Southern Russia, to the Caspian, or in conveying the army of the Caucasus with its stores from that sea to the Transcaspian railway, and along that line to Kizil Arvat. That terminus is 135 miles from Askabad, to which place the railway will doubtless be carried. Askabad is 186 from Sarakhs, and Sarakhs is 202 from Herat, only a few miles more than the distance from York to London.

Next to her own resources for a campaign, Russia's relations with Persia are of prime importance. No doubt, Persia fears more than she loves her powerful and ambitious neighbour. It may well be that the man-stealing tribes on her borders were regarded as fulfilling a purpose in opposing difficulties to the Russian advance, which more than atoned for the disadvantages of their vicinity. During the war between Russia and Turkey the Shah adopted an attitude of neutrality, but at the same time made in 1876 and 1877

some considerable military preparations for possible contingencies. He assembled an army of nearly 40,000 men, purchased and converted rifles and cannon, and fortified Teheran. In 1877 a Russian General spent some time in that city, bringing with him a large sum of money, to which may possibly be attributed the maintenance of Persia's neutrality in a war where religious affinity might be supposed to incline her to join with the Mahometan Power. In the same year the Indian Government evidently considered Persia as open to alliance with us, for, alarmed as before mentioned by Lomakin's first expedition, it recommended "That British influence be re-established in Persia, by assuring the Shah that His Majesty will have adequate support from the British Government in offering opposition to further encroachments in the direction of Merv." And the Persian Minister for Foreign Affairs was informed that Her Majesty's Government were prepared to afford their moral support at St. Petersburg to the protest, which the Shah's Government had intimated its readiness to make, against the threatened occupation by Russia of part of the Oasis. The Shah expressed his thanks, but the protest was obviated by Lomakin's retreat.

In Lomakin's two first expeditions against the Oasis, Persia denied assistance to him, and the privilege of passing through Persian territory in his advance. In 1879, Sir Charles MacGregor, on the Staff of the Indian Army, after a journey through Khorassan, published, along with the narrative of his travels, a proposal to dispatch British Officers to discipline the Persian army, and to raise and pay Persian troops of all arms to the extent of a full army corps. And in 1880 the Government of India had actually resolved to place a Persian garrison in Herat for the protection of British interests. But in the following year, after Skobelev had established himself at Bami, a remarkable change occurred in the attitude of Persia. Ostensible orders to the contrary notwithstanding, he was allowed to procure vast supplies of provisions from Khorassan; and when, after the capture of Geok Tépé, he marched beyond Askabad in pursuit, he was allowed to violate Persian territory without remonstrance, and the Turcomans who escaped into what they supposed to be the neutral territory of Persia were handed over as prisoners to the Russians. In fact, how can Persia, without the strongest support, resist such a neighbour? The Russian border is coterminous with hers from Mount Ararat to beyond Askabad. The fleet on the Caspian, and the new railway, give Russia the means of invading at a hundred points the bordering territory, furnishing a hundred good reasons why Persia could no more oppose the will of Russia than the mere human being of her own tales could oppose the tremendous spirit who rose in clouds from the sea, or descended on overshadowing wings from the sky. There is nothing therefore to prevent Russia from continuing to push her railway forward. The line from Askabad to Herat has already been surveyed by a Russian agent, and found to offer no difficulties. It will run through a green and partly cultivated plain, which feeds vast flocks of sheep, stretching along the base of the mountain range of Khorassan, and watered by many streams that pour down the hill-sides.

The scheme of this railway originated with the Russian General Annenkoff. Possessed, ostensibly at least, by the idea that the shortest route to India from this country for all purposes of trade and transport would be found to lie through Russia, he put forth in a small book the plan of a line by Paris, Warsaw, Moscow, Odessa, Baku, Michaelovsk, Kizil Arvat, Sarakhs, to Herat:—so far extended the Russian section, where it was to join the English section of the line from Herat through Kandahar and Quetta to Sukkur on the Indus. Now the only points of this plan (which appears to contemplate, among other kinds of traffic, the dispatch of our Indian reliefs) that need at present be considered are these:—1. That part of the line contemplated from the Caspian eastward is already complete; and 2, that he evidently considers its extension to Herat to be solely dependent on the will of the Russian Government. He employed an engineer named Lessar, who, after surveying the route for the railway as far as Sarakhs, continued his explorations to Herat. Not to trouble you with figures which you can ascertain for yourselves, I will only mention that from Askabad to Herat is 387 miles, and from Sibi (our present terminus in Kelat) to Herat is 600 miles.

Finally, while dealing with the approaches to India, it is necessary, in the present state of relations between Russia and Persia, to number among them the roads to Herat through the Persian territory of Khorassan. From the southern shore of the Caspian a highway exists, recently traversed and described by Mr. O'Donovan, the well-known correspondent, and by Sir Charles MacGregor, to Askabad, through Shahrood and Meshed, and the other, north of it, is described as even better. Even if Russia permits this portion of territory to remain Persian, there seems to be no doubt that her transit by these routes would not be opposed. And in Skobelev's project of invasion, to which I have already adverted, he enumerates among the advantages open to Russia, these—"That the country from Astrabad to Herat and Cabul is in every respect favourable for the passage of considerable forces. By exercising adequate political pressure on Persia, Khorassan might be rendered a base for supplies—Transcaucasia, Transcaspia, and Persia furnishing the transport." Thus he wrote in 1877; since when, as I have pointed out, the "adequate political pressure" may be exercised under irresistible conditions. And it is hardly necessary to say, how important such routes would be as additions to the means of transporting a large army.

Thus far, then, we see the position down to the end of last year. But there was still an obstacle to Russian progress to be removed. Across some strips of desert lay the oasis of Merv, with its myriads of truculent horsemen, whose trade was rapine, and who might be called the enemies of the human race. Its independent existence also caused a gap in the symmetry of the Russian frontier.

Now it is remarkable that the Russian Government never positively denied all intention to take Merv. On the contrary, it avowed that occasion might arise to cause its annexation. But there have never been wanting British politicians to deny, or to make light of, the imputed design. At length that design was consummated, and the

debates in February last may be studied by those who desire to see how it was effected, and to what extent it has stimulated the public expression of our apprehensions. Commercially viewed, Russia has gained in Merv for the present merely a fresh burthen. The Turcomans, debarred from brigandage, and unfit for any sustained commercial or agricultural enterprises, will be but an impoverished community. They possess no towns nor institutions, nor territory, which exhibit any mark either of prosperity or of the faculty of becoming prosperous. The one advantage of the possession is that the caravan route passing Bokhara to Meshed and the interior, and that from India by Herat to Central Asia, lie through Merv. But that it was once a centre of great prosperity is proved by the fact that the remains of four great cities exist there, the inhabitants of the last of which were driven out by the present semi-barbarians about a century ago. Under Russian rule that prosperity will revive—the land will once more teem with the crops to which nothing is wanting but good husbandry. And, when once again become populous and fertile, it will afford a secondary base against the Afghan frontier. In the meanwhile it closes the gap aforesaid, and as soon as Russia lays down her frontier line, the whole of that vast empire from the Baltic to the Danube, thence along the Black Sea, across the Caucasus to the Caspian, along the Persian frontier to Merv and Turkestan, and so on to Siberia, will lie in a ring fence. This is the Power which is now separated from a frontier which, presumably, we cannot allow her to overstep, by a borderland which is a barrier in no sense, and which I will endeavour briefly to describe.

Northward from the bases of the Afghan hills, till it joins the great Transcaspian wilderness, spreads the desert. Across the space from the Hari Rood to the Oxus you will find various frontier lines drawn in different maps. Years ago, in Lord Clarendon's time, he and the Russian Ambassador of the period came to a verbal agreement, and drew a line across a country of which neither of them, I imagine, knew anything, from Sarakhs to Khoja Sale on the Oxus. In Keith Johnston's Atlas you will find the frontier drawn much nearer to Herat, and in Wyld's map nearer still, while our own Government maps are by no means of one accord as to this frontier line. This is, of course, in great measure owing to the fact that there are no localities in this space which could be used to define the boundary, and it was therefore merely a geographical expression. And while the Russians were still behind the Oxus on the one side, and behind the Caspian on the other, there seemed perhaps no pressing reason why this spread of desert should not be left unclaimed by either Power. It is inhabited on both sides of the Moorghab up to a line above the fork of the river at Pendjideh by Turcomans, resembling in their habits those of the Oases already described. They appear to have owned no real allegiance to any State, though in recent years they have paid tribute to Herat. From Khoja Sale to the fork at Khoja Gahr, the Oxus seems to have been accepted without dispute as the boundary of Afghanistan. Towns lying within that frontier, as Maimene and Balkh, though not Afghan towns, nor held by Afghan

troops, are tributaries of the Ameer. Higher up the Oxus the frontier line is not uncontested, but I will content myself with noting that fact, without entering into the matter in dispute, because I do not wish, by considering secondary and comparatively unimportant points, to draw attention from the principal subject of this paper—the main Russian advance.

Many circumstances have indicated of late that our great neighbour was as restless as ever, as unappeased in the absorption of territory. It was believed that a secret Treaty existed between her and Persia. The railway project implied that Russia was prepared to absorb fresh tracts. Russian Officers had put forth pretensions to slices of Khorassan; and I have seen a map prepared in the Topographical Department of St. Petersburg, by a well-known member of it, in which the Russian frontier is drawn as far as Baba Darmuz, the furthest outpost from Askabad at that time; and leaving a gap, starts again from the Hari Rood, near Koosan, towards the Oxus. This gap was ominous, indicating that the Russian limits were still undeclared, and that indefinite encroachments might be contemplated. The map had not received the official stamp, but it is a familiar Russian manoeuvre to put forth pretensions in this way, which seldom fail of subsequent realization.¹ In connection with this, we have lately been startled by the news that Russia is in Sarakhs. Now there are two points so named opposite to each other on the banks of the Hari Rood. That on the left bank is a Persian city and fortress, that on the right an old town probably little more than a mark on the map. The difference is in one respect important, for in the one case Russia would be occupying Persian territory, by Treaty with Persia, in the other she would be merely making progress in the direction which she asserts her right to follow. But whichever of these points Russia may have occupied, she has carried her advanced post forward 185 miles at one stride, and has close to her the resources of the Persian fortress, a place of high importance commercially and strategically.

Now when we remember that the possible annexation of Merv was at no distant time regarded as a terrible menace, even only in connection with the small and far-off army of Turkestan—a menace, in the opinion of many, calling for a rejoinder from us in the immediate occupation of Herat—it will be seen how immeasurably more important is this appropriation of territory so much nearer to the Afghan frontier (*on* it, indeed, according to the agreement I have before adverted to), and forming the point of that new Russian advance behind which lie the almost inexhaustible forces of the Caucasus and of European Russia.

It will no doubt be said, as of all Russia's advances in Asia, that this still leaves her at a great distance from our own frontier, the Indus. I will therefore first ask you to note the geographical and

¹ On the day the lecture was delivered I saw the Russian *official* map, corrected for 1884, which brings the Russian frontier coterminous with the Persian, up the Hari Rood to near Koosan, crosses on a line about 40 miles from Herat, and includes Pendjeh for Russia

strategical conditions which cause us to attach so much importance to the Afghan frontier. The great hill ranges which stretch along the whole of the northern boundary of India to between Peshawur and Cashmere are thence prolonged in the space between the Upper Oxus on the one side, and Cabul and Herat on the other, where a branch, passing some 50 miles north of Herat, obliquely crosses the Hari Rood, and by the south of Meshed connects itself with the frontier of Khorassan. The mountain range from Meshed to Astrabad was once regarded as the defence of India against invasion from the side of the Caspian or the Lower Oxus. This defence has disappeared with the Russian advance. Of the remainder, the space between Herat and Cabul is blocked, for all practical purposes of war, by the rugged hills of the region. On the side of Cabul and Peshawur, there are a few difficult passes leading from the Upper Oxus into the valley of the Cabul river. Thus, there is a continuous mass of mountains along the Afghan frontier. But at Herat, the valley of the Hari Rood, piercing the barrier, gives easy access to the practicable road on Kandahar. Hence the importance of Herat, "the key of India," according to a favourite phrase. Now an off-shoot from the great northern mass of hills, the Suleiman range, turns off at Peshawur, and runs along the Afghan bank of the Indus for about 600 miles. Lofty and rugged, inhabited by wild tribes, and traversed only by long and weary difficult passes, it is of itself a defence to India so far as it goes. But there it ceases, and the right bank of the Indus becomes a vast plain stretching up with little interruption to the Khojak Pass. Thus it is that an army entering the barrier at Herat sees before it the open road to Kandahar, thence across the not difficult Khojak Pass to Pishin, and thence to the great plain which forms the right bank of the Indus. This avenue, by Herat and Kandahar, incomparably the easiest route, has always been the chief commercial and military communication from Persia, Central Asia, and Khorassan to India. It is the facility of this route for entering Afghanistan, coupled with the great gap in our mountain frontier on the Lower Indus, which makes the barring of the passage at Herat so important, and which renders it so indispensable and so urgent to consider what advantages the country affords for an Afghan frontier north of Herat, now so imminently menaced. Though there is an Afghan garrison in Herat, it has never contained an Afghan population. It was formerly a Persian town, and its inhabitants seem now to be a mixed population related to the tribes which occupy the surrounding hills and their slopes towards the desert. The hill range of Khorassan, passing south of Meshed, crosses the Hari Rood obliquely, and forms a barrier between the city and the desert at about 40 to 60 miles north of Herat. Here dwell the tribes known as the Aimak and Hazara tribes, who are not Turcomans, and who, though in some degree nomadic, have property and settled places of abode, and are cultivators of the soil. They reach to the upper streams of the Moorghab, spreading down the northern slope as far as the fertile territory extends into the plain. They are of the same races as the population of Herat, they acknowledge the authority of the governor of that town, at any rate whenever

he is strong enough to enforce it, and there appears to be no reason why, so long as the Ameer is attached to our interests, they should be drawn by intrigue or otherwise within the influence of Russia. It would appear, then, that their cultivated land must of necessity be embraced within the Afghan frontier, and also that the roads forming the communication between Afghan towns, as that from Herat to Balkh and Kunduz, should lie well within the boundary. And what would seem most urgently necessary, and which had been seen to be so before the occupation of Sarakhs, is that the frontier between Russia and Afghanistan should be strictly and formally defined with all the circumstances which can render it impassable without war.

Now, although such neighbours as the Afghan tribes, turbulent, predatory, and difficult to reach, have for long been to us a source of anxiety and trouble, it is only of late years that our relations with them have assumed their present importance. The year 1876 marks an epoch in our relations with Russia in the East, for it was then that we first remonstrated with her on the subject of her attempts to exercise influence in Afghanistan. The immediate cause was the suspicious aspect which the correspondence of General Kaufmann with the Ameer of Cabul, coupled with the despatch of Russian agents to that city, had assumed. The Russian Minister replied to the remonstrance of our Ambassador at St. Petersburg by denying all knowledge of letters or agents. On copies being shown to him, he admitted that "there had been an interchange of courtesies." In 1877 a protest was made by our Government against General Lomakin's first expedition to the Akhal Oasis. The reply was, that it was merely intended to chastise the Turcomans, who infested the road between Krasnovodsk and Khiva. But in 1878 the relations between the two Powers, strained by the war in Turkey, assumed a much more menacing form. In January the armistice was signed between Russia and the Porte. In February Russia was evidently contemplating a further advance upon Constantinople. In February, consequently, our Government obtained a vote for six millions, and sent the fleet into the Dardanelles. In March the Army Reserves were called out, and in April Indian troops were brought to Malta. On her side, Russia was making preparations in Turkestan, and had assembled the three columns which were to form the corps moving on Cabul. A Russian General, Stolietoff, was sent from Samarcand through Bokhara to Shere Ali in Cabul, with the draft Treaty, which was the outcome of Kaufmann's intrigues with the Ameer, and which afterwards came to the knowledge of our Government. As already observed, the Treaty of Berlin put an end to Kaufmann's expedition, but it was not allowed to interrupt Stolietoff's mission. And a brief summary of the incidents of that mission will serve to show the nature of the action to be expected from Russia on a similar occasion.

Rumours of the intended mission reached England, when, on our Ambassador at St. Petersburg putting questions on the subject, the Russian Minister assured him "that no mission had been or was intended to be sent to Cabul either by the Imperial Government or

by General Kaufmann." This denial was given, on the 3rd July, the day after Stolietoff and his mission had started from Samarcand. After the Envoy's arrival at Cabul, another remonstrance was addressed to the Russian Minister, and a hope expressed that the mission might be at once withdrawn, as being inconsistent with the assurances so frequently received from the Imperial Government. The reply was that the mission of General Stolietoff was "of a provisional nature, and one of simple courtesy," and could not therefore interfere in any way with the pacific assurances already given.

The real nature of this mission became known from papers found by General Roberts at Cabul in 1879. These showed that Shere Ali had been invited to form a close alliance with the Russian Government, and that a Treaty was entered into accordingly. A few days after Stolietoff's arrival in Cabul, the first result of the alliance appeared in the neglect to answer the Viceroy's letter announcing the intention to send a British mission to Cabul, and when, in September, the mission entered Afghan territory, it was insultingly turned back by the Afghan officials. Stolietoff had then returned to Samarcand, from whence he addressed a letter to Shere Ali's Minister at Cabul, advising him, in case of an insurrection in India, to go on against the English—otherwise to make peace openly, and in secret prepare for war. In November, Kaufmann, whose purpose of causing us trouble was sufficiently answered, and who had no longer any intention of aiding Shere Ali, advised him to make terms with us. The Ameer, to whom Stolietoff seems to have promised the aid of 32,000 troops, finding himself thus abandoned, while the British columns were advancing, fled from Cabul with the Russian mission left behind by Stolietoff, and wrote to Kaufmann, proposing to go to St. Petersburg to have an interview with the Czar. At the same time he issued a firman to the nobles of Afghanistan, encouraging them to resist the English till the summer should bring Russian aid. In reply to the Ameer's continued appeals for aid, Kaufmann said, "I have received an order from the Emperor to the effect that it is impossible to assist you with troops now. I hope you will be fortunate. It all depends on the decree of God." Not finding much comfort in this, the Ameer never returned to his country, and died a few weeks later. Thus, though the war ended in the destruction of Shere Ali, the defeat of the Afghan army, and the occupation of the country, Stolietoff's mission, so far as it was a cause of the war, created for us difficulties in this border territory which cannot yet be said to have ceased to harass us; and it is also to be observed that it was sent at a time when no cause of quarrel with England existed, to a State with which Russia had no necessary relations, for the sole purpose of causing us serious injury and trouble.

Whilst I have thus endeavoured to include in a general view the means which Russia possesses of undertaking a serious enterprise against our Indian Empire, I would not be thought to desire to convey the idea that a war of invasion is imminent. With all her increased advantages for attack, she would find such an undertaking so costly as to be an almost insupportable burden on finances not at

present in a flourishing condition. The war of 1855, which never extended into her territory beyond the corner of the Crimea, crippled her for twenty years. The late war with Turkey was a tremendous strain on her resources. Her domestic troubles may well be deemed to absorb at present most of her care, and a great war would be quite as likely to increase as to diminish them. The modifications in the autocratic form of her government, which the spread of modern ideas must produce, will perhaps cause the substitution of some other national aims for the aggressive policy which she has so steadily pursued from the time of Peter the Great. And it is not to be supposed that the other great Powers would view with indifference such a vast preponderance as Russia would acquire if all the schemes which we give her credit for should be realized. It is to be hoped that she would have to reckon upon seeing formidable foes in alliance with England before any important conquest could be completed. These considerations may be counted as strong enough to prevent her from entering on a great struggle with us on a mere pretext of quarrel.

But on the other hand it is impossible to say how far she might be tempted if she saw us lying at such disadvantage as would seem to promise her certain and easy success—if, for instance, we should be in great embarrassments in India or elsewhere, while the approaches to its frontier were almost unguarded. However this may be, her more distinct object has probably been one less dependent on contingency, and such as she could feel certain of turning to practical account. In order to realize it we must remember that, though Indian politicians, in endeavouring to divine Russian policy, naturally regard her imputed determination to endeavour to drive us out of India as sufficient to account for her resolute and constant advance, yet that she has aims in Europe which she has kept in sight unfalteringly for the best part of a couple of centuries, the pursuit of which has cost her many almost ruinous wars, and which she is as far as ever from relinquishing. Hemmed in on all sides by territories which exclude her from free access to the ocean, her strongest desire is, and will be, for the great southern city and port which would open to her immense prosperity. By those who take the more extended view of our relations with her, the fact seems to be generally accepted that she looks to be repaid for her costly successes in Central Asia by the powerful influence they will give her as a countercheck to our opposition on the Bosphorus. The lever which is to open her way to the Mediterranean has its fulcrum on the Afghan frontier. I will here endeavour, then, to look a little more closely, in a few brief sentences, into the conditions of the pressure which she can bring to bear on that side.

In his plan of invasion, Skobeleff thought that 50,000 men might undertake the enterprise without risk of disaster. That is about the force which the army of the Caucasus put in the field in Armenia in 1877, when the great mass of the Russian army was on the Danube. In any circumstances, then, the army of the Caucasus, after leaving ample garrisons in occupation of the fortresses and depôts, could

easily direct 50,000 men on Baku. The time necessary for the movement beyond the Caspian must be measured by the means of transport on the railway. Two years ago the terminus was at Kizil Arvat. We need not look far forward to place it at Askabad, and may count with some certainty on seeing it before many years have passed at Sarakhs. We may assume that on the railway the very moderate number (it being only a single line) of twelve trains a day can run. At the very moderate rate of 12 miles an hour, which seems to be that maintained at present, the journey would occupy forty hours. The successive detachments would arrive, then, easily in two days at Sarakhs. A division may be conveyed complete in thirty-six trains. Thus in six days a division would be assembled at Sarakhs, ready to move as the advanced guard. An army corps, with all its equipments and departments, would be conveyed in 165 trains in seventeen days. It would then be 200 miles, say another seventeen days' march, from Herat. Thus, adding a day for the crossing of the Caspian, the army corps from Baku would be assembled at Herat in thirty-five days, or five weeks. But if the single division were sufficient of itself to march on Herat, it would reach that point from Baku in about three weeks. A single train a day suffices to supply an army corps with food and forage; and a single railway more than amply suffices for all supplies and reinforcements required by an army four times greater than that I have been supposing. Consequently the railway could supply any additional force such as might be forwarded from Russia to the Caspian *via* Petrovsk, while the free use of the roads through Khorassan, from Astrabad to Sarakhs or Herat, is another highly important element in estimating the strategical advantages which Russia will possess. It may be looked on as certain therefore that, in a few years, Russia will possess the means of at once entering Afghanistan, at the outset of a campaign, with the advanced guard of an army the forces of which will be drawn and maintained from all the resources of the Empire. Also, the advance of a corps from Turkestan upon Cabul is even more practicable than formerly. And it is quite possible that the preparations for such a movement may be completed before we are aware, because they will all take place within her own territory.

As the case of invasion has been often speculated on, though never under such formidable conditions as now, I will glance briefly at the alternative plans which have been proposed for meeting such a contingency. One is to make no endeavour to dispute the enemy's advance outside our own frontier, but to restrict the defence, generally, to the line of the Indus. The passes of the Suleiman Mountains are to be guarded and the advance of the enemy by the Kandahar-Quetta line was to be met on the Lower Indus. No doubt there is something to be said for this plan. It is by far the least costly. The railway from Calcutta to Peshawur, along which route the vast majority of our Indian forces are placed, throws off at Lahore a branch to Mooltan and thence along the Indus to the sea at Kurrachee. Our troops, from this route on the one side, from Kurrachee on the other, would be assembled here with the utmost ease and promptitude, about Sukkur,

the point of passage upon which the Kandahar route directly leads. Little of that vast preparation of transport, that enormous destruction of beasts of burthen, which is necessary when moving by difficult roads in India, would be demanded here, while, on the other hand (it was thus that the argument for remaining here on the defensive was stated), we should await, amid our resources, an enemy who would have advanced to a great distance from his. But the first question would be in taking up the defensive line, on which side of the river shall we place it? If in rear of the Indus, the advance of the enemy would give them the whole of the railway from Sukkur to Kurra-chee, which runs on the opposite bank, and would close to us the navigation of the Indus. This would at once sever the army from Kurra-chee, the nearest port from England. Behind the army would lie the great deserts of Sinde and Rajpootana, through which no routes pass, while, on the opposite bank, the enemy would have an immense extent of front upon which to perplex the defence, and to choose his plan of operations. Such are some of the disadvantages of taking up a position on, and not in front of, the line of communication through your flanks—a disadvantage enormously increased by running the railway beyond the river. But we will presume that these reasons oblige us to take the line of defence to the other bank. In this case the necessary conditions will be these—good passages over the Indus, protected by works on both banks, such as do not now exist, and without which the position of an army retiring before an enemy would be hopeless indeed. And nothing could remove one chief objection, that any kind of reverse would bring us at once within our own frontier, and that (according to the belief I formerly expressed) it is the concurrent testimony of all Indians, that there is no territory on which it would be more perilous to give an enemy the chance of winning a battle than our Indian Empire. Let us see what a very capable enemy thought about it, when contemplating invasion. "Everybody," says Skobeleff, "who has concerned himself with the question of the possibility of a Russian invasion of India, would declare that it is only necessary to penetrate to a single point of the Indian frontier to bring about a general rising. . . . Even the contact of an insignificant force with the frontier of India might lead to a general insurrection throughout the country, and the collapse of the British Empire."

A second alternative was to take advantage of our friendly occupation of the territory of Khelat, to carry our active force beyond the Indus and meet the first attack at a distance from our own territory, which would be covered by our advance. We should thus be free for a forward movement; we should be already beyond the great obstacle of the mountain range, and a railway connecting that of the Indus valley with the active force would render communication and supply perfectly easy.

Now the fact that the railway is already complete to Sibi, and will be carried at least to the Khojak—and that the region lying along the railway is entirely under British administration—seems conclusively to prove that the idea of restricting the defence to the Indus

has been abandoned, for it would entail the relinquishment of territory now dependent on us, and the abandonment of the railway to the enemy.

It will be noted that the railway, avoiding the Bolan, and leaving Quetta on one side, only communicates with that place by a branch. Thus, the position at Quetta does not cover the railway. But we gather from the excellent account of an examination of the country made by Sir Michael Biddulph, that the plain of Pishin beyond affords, on the border towards the hills, an excellent position for a large force, and well watered. And in front of this position, forming a rampart to the plain, is the range across which lie the Khojak and Gwaja passes, on one of which the railway will be directed. When it is carried so far, we shall possess here a very advantageous locality in which to oppose an advance.

In viewing all plans of defence, it is necessary to bear in mind the complete distinction between the two halves of the country beyond the Indus. While the lower, the southern half, is a great plain, the railway across which leads to another great plain, and by an easy road thence on Kandahar, the half beyond the Upper Indus is a huge block of rugged mountains marked roughly by the four points, Peshawur, Cabul, Kandahar, Mittenkote. The passes through these hills are of an exceptional kind, and must not be viewed as ordinary passes, such as armies have frequently moved through in Europe, in one or two marches. These passes are from 200 miles to 300 miles in length; many weeks are occupied in traversing them. At great distances from each other, the intervening country is occupied by half-starved savages, under nobody's control. For these reasons I contested the proposal to push our Indian frontier through to the Afghan side of these passes, and pointed out their peculiar disadvantages as lines of operation. These were strongly illustrated in the military movements which took place shortly after the former lecture was delivered, when an enormous proportion of the operating forces was absorbed in guarding the communications through the passes. The Kyber alone absorbed 15,000 infantry, nearly 3,000 cavalry, and 34 guns. For these reasons, I proposed to restrict the upper half of the line of defence to the space between the Indus and the mountains, to place intrenched camps¹ there at the issues of the principal passes, to make a good road connecting them throughout, and branch lines connecting them with the main railway. In this way the upper part of the line would be, at the outset of the campaign, stationary, and a pivot for the active army beyond the mountains.

Both these plans leave Afghanistan entirely unoccupied by the British. The enemy's immediate base would then be the fortified triangle—Herat, Cabul, Kandahar, and the opening scenes of the war would, in the case of our occupying the position at the head of the

¹ I think I have been misunderstood to mean works occupied by permanent garrisons. What I really meant was detached works, occupied only by troops sufficient to take care of them, and which would, when completely garrisoned, be formidable in themselves, and would constitute a strong support to the field force manœuvring near them.

railway, take place in the region from Pishin to Kandahar. But there was a third alternative which, considered only from the military point of view, met with very general acceptance. It was that we should not await the enemy outside Afghanistan, but should ourselves advance and occupy Kandahar. This would at once seriously interrupt the communications between the parts of the enemy's front, for a mass of hills practically impassable fills the space directly between Herat and Cabul, and the best, indeed only, route between them, except the hill road by Maimene and Bamian at the back of the range, lies through Kandahar. Here we should command the open roads to those cities, and being at the back of the Suleiman range, our presence there would be almost decisive against any attempt to invade India through the passes. It has for these reasons, and others which I will not here recapitulate, that I said in 1878: "I think our position vastly improved by the occupation of Quetta; but I should think it all we could desire if we occupied Kandahar."

A year later we did occupy Kandahar. The Home Government and the Government of India were then considering what we should do with Afghanistan, and a hopeless puzzle it seemed, for, says the Secretary for India to the Governor-General on the 21st May, 1880, "it appears that as the result of two successful campaigns, of the employment of an enormous force, and of the expenditure of large sums of money, all that has yet been accomplished has been the disintegration of the State which it was desired to see strong, friendly, and independent, the assumption of fresh and unwelcome liabilities in regard to one of its provinces, and a condition of anarchy throughout the remainder of the country." Such was, and such would be again, were we to abandon it on the approach of an enemy, the condition of the country which must, in that case, fall entirely into the hands of Russia.

On the 12th May, 1880, Sir F. Roberts at Cabul wrote a memorandum on the situation. After recommending that the troops should entirely evacuate the northern passes and withdraw to the Indus frontier, he says: "Kandahar, where we can, if we so desire, permanently station a garrison of British troops, is being rapidly brought into communication with the main railway system of India, and will soon be (as regards time) within a comparatively short journey of the rising and important seaport of Kurrachee. This port must inevitably be the base of all military operations undertaken in the direction of Kandahar-Herat, which line, unless I am much mistaken, will henceforth be the theatre of any war carried on by us against the Afghans or Russians in Central Asia." And in the same paper he says: "On Kandahar I maintain our grasp should never be loosened."

All this time down to 1881 the question of the permanent occupation of Kandahar was anxiously considered. Many political and military authorities were consulted. Some were for, some against it. But it is observable that not one of its opponents contemplates the case from the point of view of the facts that now exist. In 1880 it

was still held that the changes present in 1884 were far distant, and that the task of providing for them might be postponed to another generation. Thus I find a member of the Council asking, "Is it possible for any one to say that we now really dread a Russian invasion of India? Has not our experience during recent operations in Afghanistan, comparatively close to the magnificent resources of India, and the accounts we read of Russian difficulties when operating against undisciplined tribes in Central Asia, dissipated the apprehensions of the most inveterate of Russophobists? . . . Is it possible to apprehend that Russia is likely to subjugate or to influence Afghanistan so as to make it a base for operations against India? . . . It is more than ever evident that any Russian advance, if indeed it is possible, would be made at great risk, and that it must be effected with so much slowness and deliberation as to give us leisure, twenty times over, to occupy any or all of the posts on the scientific frontier, and also Cabul and Kandahar, before a Russian advance could have made itself felt." Danger from Russia he says "is so remote that its possibility is hardly worth considering." Another says, "We may therefore conclude that Russia will not now undertake any operation in Central Asia beyond those necessary to chastise the Tekke Turcomans." Reading all the opinions called for, I should say that they immensely preponderated, both in number and weight of argument, in favour of retaining Kandahar, which we at that time continued to occupy. But those which coincided with the manifest desire of the Government were held to be decisive. We withdrew from Kandahar, and Russia's response has been the annexation of Merv and the occupation of Sarakhs, and the urgent matter now is whether the question of occupying Afghanistan, formerly decided on grounds that have vanished for ever, should be reviewed. That in certain contingencies it was open to such review seems to me to be proved. If ever, it must be reviewed now. No one can say in how short a period the opportunity may not be irretrievably lost.

Now, in reviewing the situation a great change will be seen to have taken place in the possible relations between India and Afghanistan. Hitherto there have been but two alternatives contemplated. There was the party which desired to see a British force in Afghanistan, with good communications and strong fortified positions, thus carrying forward our military frontier from Indian territory. There was the other party which desired to see an independent, or quasi-independent, Afghanistan, where the tribes were to be brought together under a native ruler, and where that ruler was to be subject to British influence, and held in close friendly alliance, and the territory of which was to be the inexpensive rampart of India. This second alternative no longer has any existence. With a Power like Russia closing on it, holding Persia and Persia's resources subject to its will, it is in vain to think that Afghanistan will be long independent even in name. It is between hammer and anvil or, to use a still more expressive metaphor, between the devil and the deep sea. Bound to us by no traditions, by no strong political influences such as might have been used to constrain them, the Afghan tribes, mercenary and per-

fidious to a proverb, an aggregate of tribes, not a nation, will lose no time, when the moment occurs, in siding with the great Power which promises most lavishly, or which can lay strongest hold on them. Now if, in such a case, we should, in accordance with former counsels, not without their advocates at this time, keep within our present frontier, and allow Russia to annex Afghanistan, to occupy it with her troops, to enlist its tribes in her service, the case will not be the same as that which I have already supposed, namely, that we hold this retired line in order to meet an invasion. That would be a temporary measure during war. But this latter would be a permanent measure during what we may please to call peace—a kind of peace in which, as many think, there would be an end for ever of all tranquillity in our Indian Empire.

The first step then is to realize that, if the Afghans are not with us, they will be against us. And here I must pause to notice an argument which has often been used for the policy of remaining as we are. It is said that if Russia were to seize Herat we could always, from Pishin, anticipate her at Kandahar. Now when we speak of occupying Kandahar, it is not merely the city that is meant. To hold a city against a besieger bringing modern artillery to bear on it, is to doom it to ruin, its inhabitants to destruction. Positions must be held at a distance—in this case up to the line of the Helmund. These positions, in order to draw from them their full advantage against such forces as the Russians could bring on us, should be carefully fortified with earth-works, and armed with artillery more powerful than could follow the march of an invader. Sir Michael Biddulph, in a valuable report made from personal observation during the last Afghan war, says, "The position of Girishk is with the most modest precaution unassailable—all the passages of the Helmund can be defended by suitable works at short notice." This being the first line, he describes a second strong line behind it—and a third, if necessary, is to be found, he says, on an arc extending from the edge of the desert. "Inside this arc," he goes on, "lies all the productive country, while without it the country is sterile and an open glacis." "It seems to me," he adds, "that even though invasion may be remote, the possession of this point has an importance which cannot be rated too highly." It is upon the Helmund then that we must direct our march, if we occupy Kandahar. And if we do not occupy it, we can never be certain that Russia will not anticipate us on the Helmund.

Now, in considering a possible extension of frontier, we must not forget that the Government of India, looking at it from the Indian point of view, sees great difficulties in the way. From Calcutta to the Indus is 1,500 miles. The frontier from Peshawur to Kurrachee extends 1,000 miles. Having to deal with such enormous distances already, it is naturally predisposed against an advance. But let me point out—what I have already quoted from a memorandum by Sir F. Roberts—that the base of an army in Afghanistan should not be India, but Kurrachee. From thence to Kandahar is 650 miles—a distance, were the railway completed, to be measured by hours, just about the distance from Plymouth to Edinburgh.

Here, then, I will put to you the two cases which it is a main object of this lecture to present. I will suppose Russia to have made her next step—a step which need surprise nobody; many Indians look on it as already virtually accomplished—and occupied Herat. We know when she will do this—in a moment of perplexity to England. As to the how, perhaps by first occupying it with a Persian garrison (not to alarm us too much), and afterwards, by some subsequently announced Treaty, replacing that garrison with Russian troops. This may easily be done before we are aware, especially if we follow the plan of respecting Russian susceptibilities so far as not even to keep ourselves informed of what she may be doing. And it was a feature of Skobelev's plan of invasion, now become absolutely feasible, "to organize masses of Asiatic cavalry, and hurling them on India as our vanguard, under the banner of blood and rapine, thus bring back the times of Tamerlane." We may therefore wake up to find this programme in execution, with Russian troops to any extent massed along the line of the Transcaspian railway, ready to support those in front. Now, on our side, we have of late increased the force at Quetta, and planned a system of local defence for Beloochistan; but our comparatively insignificant field force is 220 miles from the Helmund. That is one case. The other is that we had a strong British Governor in Kandahar, and a strong British force on the Helmund and on the road to Cabul—the railway completed to Kandahar—in case of a movement from Turkestan against Cabul, a force on our side on its way to occupy that city, if not already there, and new recruiting grounds open to us amid warlike populations. Surely there can be no question as to which of these two sets of circumstances would give us most influence in Afghanistan, most power to oppose Russia, and to maintain confidence in India. And we must remember that four years ago we could have done this and more than this. The whole country was going to pieces for want of strong rule. We were actually hunting for rulers. We set up one at Cabul, and another at Kandahar, who was soon afterwards removed, and the whole country placed under the present Ameer. Before and since that event the unwavering theory of successive Governments of India has been that the Ameer is to be kept from Russian influence, and to be maintained and supported in alliance with England. But when we ask what steps have been taken for carrying this theory into practice, I fear we shall not find much that is satisfactory. Perhaps the utmost we could in present circumstances promise ourselves, in meeting a Russian advance, would be that after heavy fighting and vast expenditure we should succeed in gaining those positions which are now open to our grasp, and our presence in which might obviate the risk of war.¹

I have said nothing about a British occupation of Herat. Yet that too was open to us four years ago, and not only open to us, but contemplated, in certain contingencies, by the Government of India.

¹ And here I may mention that, since this paper was printed, I have seen evidence that most of the views here set forth are shared by an Indian Officer whose name would be at once admitted as of almost decisive influence in the question.

If I refrain from speaking of it it is because I fear at the outset to excite the opposition, and possible refusal to consider *any* forward movement, of those who are already hampered by the opinions they formerly expressed. I am aware, too, of the strong reasons that exist against straining our resources by embracing points so distant in our first operations. But I will confess that as an abstract military plan for the defence of India under present conditions, and supposing sufficient additional troops to be forthcoming, that which most strongly recommends itself to my mind is a strong British Government at Kandahar, wielding an army whose advanced troops should be at Cabul and Herat, based on Kurrachee, with railway communication at least thence to Kandahar. I believe it is considered that great part of such an army could be supplied from our present Indian forces. However, I will not enlarge on this plan, though I imagine it is what a strong Power, thinking more of security than expense, might be expected to adopt. But, assuming that we wish to keep our hold on this rampart of India, it is urgently necessary to take steps while the Russian preparations are still undeveloped. We must at once obtain such a settlement of its boundary as I have endeavoured to sketch. And military reports on the whole country, from this frontier to positions securing or commanding Herat, and thence to the Helmund, should be framed forthwith. Our ignorance of all this is, considering its importance, astonishing. While Russian officials have explored up to and beyond Herat, and elsewhere along the Afghan and Indian frontier, our own Officers have been discouraged, indeed prohibited, from obtaining personal knowledge of those regions, so that the scanty information I have been able to give about them is from those who acquired it almost by stealth. An extreme care not to wound, by showing suspicion, the innocent candour of those guileless beings, Russian statesmen, appears to have been our ruling motive, and is probably dignified by the name of diplomacy. The frontier is most important to us, yet no one can say where the frontier is. In a few years we may be fighting on the Helmund, or the Hari Rood, yet we know nothing of the military features of the region. The country, made up of discordant parts, is held together by no strong rule, which we refuse to supply, while a rival Power, whom it would task all our resources to meet with every advantage in our favour, and which knows no scruples, will soon be in a position to enter it.

I have now endeavoured to set forth a statement of existing circumstances. They are not pleasant to contemplate or to depict. But I am not at all afraid of being branded with the epithet "alarmist," for events must have deprived it of most of its force. Possibly many of those who formerly used it begin to repent their opinions. I admit the difficulty of recanting them. I do not undervalue the many influences which will always oppose any policy entailing expense. But if the present question is found to be, How we shall guard against a terrible menace to our Indian Empire,—any cost to be incurred can hardly be admitted as a reason which ought to influence our course. Magnanimous trustfulness in the virtue and

guilelessness of rival States; distrust and denunciation of all who would chill this inverted patriotism by words of warning; refusal of all measures demanding expense which do not promise a pecuniary return; such is the kind of liberality of sentiment which may ruin great nations. The qualities of the lamb may be very excellent qualities, but they are specially inapplicable to dealings with the wolf. Do those who shrink from expense think that the presence of Russia in Afghanistan will be inexpensive to us? Will the weakness which will be the temptation and the opportunity of Russia be less costly than effectual defence? When we enter the councils of Europe to assert our most vital interests, shall we speak as we have been accustomed to speak, when our free action is fettered by the imminent perpetual menace to India? These are questions which, now put forth only to this limited audience, will, perhaps within the experience of most of us, be thundered in the ears of the nation. England is just now not without serious perplexities, but none are so fraught with possibilities of mischief as the storm which is gathering on the Afghan frontier.

The CHAIRMAN: After the comprehensive and most interesting lecture which we have just heard, it is very probable there are gentlemen here who will like to offer some remarks upon the subject. If so, I am sure they will be listened to with the greatest interest, especially as there are present those who can speak with authority.

Lord NAPIER OF MAGDALA: I am sure the company present are greatly indebted to Sir Edward Hamley, for the very clear and masterly exposition which he has given of the situation of the frontier on the north-west of India, and of our position with regard to Afghanistan and the frontier of Russia. It is well known that my opinions have long been in the same direction as those of General Hamley. During the administration of that great statesman whom we lament more and more every day—Lord Beaconsfield—I advocated the retention of Kandahar, and a position beyond the Khyber Pass. I recommended the occupation and retention of Kandahar as the outpost, where our force could be concentrated to defend our frontier at any point, to advance or defend it, as it might be necessary. I recommended also the position beyond the Khyber Pass, not intending to have a definite boundary inclosing all the Afreedi tribes, but to place ourselves beyond them, to put them within our influence, and gradually civilize and draw them to our side as a defence, and as a supply for our troops, or (to use the expressive words of Sir James Stephen) to make them a quickset hedge for our defence, instead of leaving them a thorn in our side. I thought also that it was not creditable to us that we should allow such a state of uncivilization to exist close to our border, which ought to have been under our influence and brought within the rules of humanity. I regret exceedingly that my views did not find favour at that time, when we had every facility for carrying them out, but it was ordered otherwise. I trust that the very able statement and description which General Hamley has given us may attract the attention of our Government, and that they may even now, before it is too late, resolve to take the measures which are necessary to give us a clear boundary of the Afghan country, which is the first thing we want, and next, to take the measures necessary for protecting it and rendering it inviolate.

Sir HENRY RAWLINSON: I have very little to add to the exhaustive summary which has been given us by General Hamley, in every word of which I believe I may say I agree. The Russian approach to India is no new subject to me. I have been during the last thirty or forty years interested in it, and the opinions which I hold at the present day are in all essentials the same as those which I have held during the whole of that period. There are only one or two points on which I would presume to supplement General Hamley's remarks. One is in reference to the import-

ance of Herat, which I think is hardly dwelt upon sufficiently; I mean not merely the military, but the political importance of that position. It must be remembered that Herat, if it is not English, will be Russian; it is impossible to leave it as a derelict in the present state of the East. Although there may be great difficulties and drawbacks and objections to its military occupation under present circumstances, yet it is well worth our while to consider whether, in the not very remote future, such a step may not be indispensable for the defence of India. The public hardly know, I think, what the capabilities of Herat really are, and I have therefore copied from an article which I wrote two or three years ago, a brief description of the fortress, which will give an idea of the strength and importance of the position:—

"The city of Herat is in 34° 32' N. lat., and 62° 9' E. long. That which distinguishes Herat from all other Oriental cities, and at the same time constitutes its main defence, is the stupendous character of the earthwork upon which the city wall is built. This earthwork averages 250 feet in width at the base, and about 50 feet in height, and as it is crowned by a wall 25 feet high and 14 feet thick at the base, supported by about 150 semicircular towers, and is further protected by a ditch 45 feet in width and 16 feet in depth, it presents an appearance of imposing strength. Whether the place is really as strong as it looks has been differently estimated. General Ferrier, who resided for some time in Herat in 1846, states that the city is nothing more than an immense redoubt, and gives it as his opinion that as the line of wall is entirely without flanking defences, the place could not hold out for twenty days against a European army; and M. Khanikoff, who, though not a professional soldier, was a very acute observer, further remarks that the whole interior of the city is dominated from the rising ground at the north-east angle, while the water supply both for the ditch and the city would be at the mercy of an enemy holding the outside country, the wells and reservoirs inside the wall, which would then be alone available, being quite inadequate to the wants of the inhabitants; but on the other hand all experience testifies to the defensibility of the position. Not to speak of the sieges which Herat sustained at the hands of Jenghiz Khan, of Timur, and of Ahmed Shah, we have only to remember that in 1837 the Afghans of Herat, under the direction of Major Eldred Pottinger, beat off the continuous attack for nearly ten months of a Persian army of 35,000 regular troops, supported by 50 pieces of artillery, and in many cases directed and even commanded by Russian Officers. The truth seems to be that Herat, though in its present state quite unfit to resist a European army, possesses great capabilities of defence, and might, by a skilful adaptation of the resources of modern science, be made almost impregnable. A British Engineer Officer, Major Saunders, calculated in 1840 that at an outlay of 60,000*l.* or 70,000*l.*, which would include the expense of deepening the ditch, clearing the glacis and esplanade, providing flanking defences, and repairing the walls, &c., throughout, Herat might be rendered secure against any possible renewal of the attack by Persia; but of course if an attack by a well-appointed European army were anticipated, more extensive preparations for defence would be required, including, probably, the erection of two independent forts on the high ground at Mosallá and Takht-i-benzí."

In giving this description of the capabilities of Herat, I leave out of consideration for the present the burning question whether England or Russia is to be in occupation of the fortress; but this I will say, that whether the place is held by Persian troops, controlled and directed by Russia, or whether it is held by Afghan troops controlled and directed by England, Herat, I am satisfied, will be, whether for good or ill, one of the most important, if not *the* most important, military and political factor in the future history of the Eastern Question. I have listened with the greatest interest to General Hamley's lecture, and cordially agree with him in all his opinions. On one or two small points, however, I think there might be some correction with advantage. One is with reference to the new Herat frontier, as laid down in what General Hamley calls the official Russian map, and which he supposes to have been definitely adopted. For myself I confess I consider the whole question of the frontier to be *in nubibus*. The map, it is true, has been published officially by Russia, but it has not been communicated officially to the British Government, and should it be so communicated I doubt very much if it would be

accepted. The correction which I have thus noticed merely regards the line of frontier which is drawn to the vicinity of Herat. In all other respects, whether relating to geography or strategy, his observations seem to me to be most accurate, and command not only my acquiescence, but my unqualified admiration.

Colonel MALLESON : I venture to think that there are other reasons than those put forward by Sir Henry Rawlinson why Herat constitutes a very important factor in the question under discussion. It is not alone because the fortress of Herat is of the strength described by him, but because also the country itself is so well capable of supporting an army, abounding as it does in mines of lead and iron, producing the particular kind of tree which is best adapted for making gunpowder, and being of an extreme fertility. In occupying Herat, then, Russia would occupy a country which would become a new base of operations in connection with India. It is not alone that Russia could occupy that country. It would lie there perfectly at ease until the time of disturbance arose in India, meanwhile intriguing with the native princes of India, and then when all the preparations were complete it would make a spring in advance. I dare say it is known to one or two gentlemen here, that since the question of abandonment of Kandahar was mooted four years ago, I went out to India for the purpose of ascertaining what was the opinion of influential natives of that country on the question of the abandonment of that fortress. With one voice they said to me, "Are you mad? At the moment when Russia is subduing the Turcoman cavalry and enlisting in its own ranks that cavalry which constituted the vanguard of the previous invaders of India—are you mad, at such a period to abandon that fortress which covers the one gap in the line of your defence in India? If you do abandon that fortress at this period we tell you what will take place. Russia will continue her advance, she will not stop until she has gained the fertile country of Herat, and when she has gained that country she will intrigue with the native princes behind the Indus, and then when you send an army to meet her you will find those native princes rise in your rear." I may fortify my own experience by relating what was told me by an Austrian gentleman who visited India about seven years ago. He paid a visit to the Maharaja of Cashmere, who, when he found that this gentleman was not an Englishman or a Russian, said to him, "From you I hope to get the truth, you are not an Englishman, and you are not a Russian; tell me which is the strongest, the English power or the Russian; because it will be necessarily my duty if Russia should advance, and if I should find Russia stronger than England, to go for the defence of my throne on the side of Russia." You may depend upon it if Russia occupies a predominant position on our frontier—a position from which she could invade India at her will—as she will be able to do if those precautions so urgently recommended by Sir Edward Hamley are neglected, you may depend upon it that that course which she has tried with a great many other Powers, which she tried in Georgia and in Circassia, will be tried in India; she will send her skilled and tried agents to the courts of the native princes, and India will be undermined before she commences her invasion. Therefore, with all the earnestness of my nature I pray that the rulers of England may yet listen to the voice of Sir Edward Hamley. I heard him four years ago, when he delivered that able lecture on the retention of Kandahar, and I regretted, as much as any man in this room can regret, that his advice was neglected. If his voice is unheeded now, the day will come when it will be too late to arouse from the stupor which now quenches the voice of the British nation, and when we may have only to lament the loss of that which we might so easily have preserved.

Sir LEPEL GRIFFIN : I have only to express my general concurrence with the subject-matter of General Hamley's able lecture, and to add a few words which may be excused on the ground of my having had something to do in the way of practical work in Afghanistan. I cannot but think that somewhat too great stress has been laid in this lecture on the likelihood of the Russian occupation of Herat, and for these reasons. The war in Afghanistan has entirely altered our political relations with that country. Afghanistan is to-day, as is Beloochistan, as much a portion of the British Empire in the East as Bokhara and Khiva are portions of the Russian Empire. The Ameer is now, and I hope will in future more firmly be, under distinct engagements as to the conduct of his foreign policy, and we are bound to protect him against foreign aggression with the whole strength of the Empire. It is certain

that Russia desires to obtain possession of Herat, but I do not think she would be willing to attempt it if Mr. Wyld and our geographers, on the authority of the British Government, were to draw the red line which marks the English dominions across the northern frontier, and if our determination to defend Herat as we would defend the Isle of Wight, by force of arms, were clearly understood by Russia. With reference to the remarks made by Colonel Malleeson and Lord Napier, as well as by Sir Edward Hamley, on the subject of Kandahar, I would observe, without raising controversies which would be out of place here, where discussion is unconcerned with party considerations, that one reason for the abandonment of Kandahar, to which I think the English nation generally has not attached sufficient weight, was this. In all my negotiations with the present Ameer of Cabul, the point upon which we laid the greatest stress was the impossibility of governing that country without the possession of Kandahar, from which the Ameer have been accustomed to draw the greatest part of their revenue. Cabul itself is an exceedingly poor and barren country, with the exception of a few valleys, and from Kandahar and Herat the Ameer naturally looked to obtain the revenue by which he might maintain his administration. It was believed by the Government, and I certainly agreed at the time, and am equally convinced now, that if we left Kandahar out of his dominions, we should have in the Ameer of Afghanistan a secret if not an open enemy; he would never be the friend of the Power who took and held from him Kandahar. For this reason I then held, and hold still, that our permanent occupation of Kandahar was inexpedient, if we were to retain the friendship of the Ameer and the Afghan people. I do not, however, deny the importance of Kandahar, and I foresee the time when we may again occupy both it and Cabul, but I hope when that time comes that it will not be a temporary military occupation, but a permanent annexation of the country. It is far easier to annex than to occupy. In the last position everyone is your enemy; in the first all who have anything to hope from your favour or protection are your friends. Our real difficulty in Afghanistan, and that with which I had every day to fight, was that there was not a single man who gave me any assistance who did not realize that the moment we left the country his throat would probably be cut, and I may incidentally mention that almost every one of them has had his throat cut. I do not think that on this point I need say farther than to express my general concurrence with General Hamley's opinions, and a hope that the Government will take such measures for the delimitation of the northern frontier as to make it impossible for Russia to advance on the line laid down without a declaration of war with England. I think that this should be distinctly understood by both countries, for it is the only safeguard against aggression. No railways, no forts, no agreements are of the least use unless the English Government—I do not mean the Government of to-day or of to-morrow—unless the English Government, supported by the voice of the people, insist that Russia shall no more cross the Afghan frontier than that her troops should land on the coast of Kent or Sussex.

THE CHAIRMAN: There is just one question on which I think that Sir Lepel Griffin or some other speaker may be able to enlighten us—I mean the result of the occupation of Quetta as regards the people around it. Has it alarmed or satisfied them? The point is important in its relation to Kandahar.

SIR LEPEL GRIFFIN: The occupation of Quetta, which was made when I was Secretary to the Government of the Punjab, was opposed by the Ameer Shere Ali of Cabul, but was never distasteful to the people of Beloochistan. Before we went to Quetta, as many Officers of experience like General Merewether can testify, the country was in a state of complete and constant anarchy. Since we have been there, it has generally enjoyed peace and tranquillity. We have had a few raids of Murriss and Boogtis on the southern Punjab and Sind frontier, but the country has generally been perfectly quiet. The Khan of Khelat is not possibly more delighted at the presence of our garrisons than the Ameer of Khiva is at the presence of the Russian garrison. At the same time he is openly our friend, and has given us every assistance in his power, and certainly if we had not been there he would have been deposed long ago. There has been no opposition as far as I am aware.

SIR WILLIAM FRASER: I did not quite catch what Sir Henry Rawlinson said; but he referred to what seems to me a thoroughly vital point. If I understood him rightly, he said that, should the official map of Russia be presented to Her Majesty's

Government showing that the frontier had been extended below Sarakhs, immediate steps would be taken, either of a friendly or hostile kind, to alter that frontier. At present I understand that the non-official frontier is where I see it marked on the map; but that the official frontier has not been so announced. That seems to be a very important point; whether it has been or will be so announced; and what steps Sir Henry Rawlinson thinks will be taken upon its official announcement.

SIR HENRY RAWLINSON: What I said or intended to say was this, that the map to which Sir Edward Hamley referred, and which is an official map in so far as it has emanated from a public office in St. Petersburg, is not the Government map. It is not the map of the Foreign Office, it is not the diplomatic map; and it is the diplomatic Foreign Office map alone with which the English Government concerns itself. We have drawn the attention of the Russian Government to the map in question, and the only answer we have received at present is that the Foreign Office does not acknowledge it. It has not proceeded from that department, but has been issued by the War Office, with which the Diplomatic Department has no immediate relations; at any rate the Foreign Office disclaims all responsibility for War Office publications. At present the subject is under discussion; and from assurances we have received, we do not think that the Foreign Office will acknowledge and become responsible for a map which extends the Russian frontier to the immediate vicinity of Herat. As far as Sarakhs is concerned it does not appear that any diplomatic objection can be raised to the Russian occupation of the Old Sarakhs, which is to the east of the river forming the boundary of Persia, the land of Old Sarakhs having always been considered to belong to the Turcomans of Merv. Recently, within the last few years, that is, since the Russian successes against the Turcomans, those lands, it appears, have been occupied by Persians, and the Turcoman owners have now appealed to Russia to rescue the lands for them. This is, we believe, the true explanation of the Sarakhs question which has attracted so much attention. The Russians are now engaged in restoring the lands of Old Sarakhs to the Turcoman owners; and to this we can take no legitimate exception, because if we consent to the annexation of Merv, we admit the right of Russia to those lands which are to the east of the river and are included in the Merv territory.

LORD NAPIER OF MAGDALA: I should like to say a few words, not in contradiction to what Sir Lepel Griffin has said, because he speaks with an authority far beyond anything that I possess with regard to the feelings of the Ameer of Afghanistan, but I wish merely to explain that when the retention of Kandahar was thought of, it was advised that the revenue the Ameer would draw should be made over to him, so he would receive the whole revenue he could get from Kandahar without the trouble of collecting it, and at the time it was proposed I think Abdurrahman had not been discovered.

LORD CHELMSFORD: I feel that I am somewhat presumptuous in standing up to take part in this discussion, but as at present nobody has ventured to differ from the lecturer, and as I, when the discussion on the occupation of Kandahar in the House of Lords took place, ventured to express an opinion in opposition to that of those who have just spoken, I feel that it would be an act of moral cowardice on my part if I refrained from again stating what my opinions are on the subject. The lecturer admits that the frontier of India, as represented by the Indus, is a very strong one for defence; and so far as I understand he only deprecates any defence of India on that line because it would have the disadvantage of the defending force acting purely on the defensive without being able to take the offensive. I have, however, never myself advocated that the left bank of the Indus should necessarily be the actual line where opposition to any Russian force advancing on India should be offered. I always contemplated, what has now been done, that the territory of Khelat should be occupied, so that, if thought desirable, we should be able to place ourselves on the flank of a force advancing from Kandahar upon the Indus. If our army in India were twice as strong as it is at the present moment, I would not be prepared to say that the plan advocated by the gallant lecturer might not be carried out with advantage. I think there is a great deal to be said for it, as well as for the plan shadowed forth by Sir Lepel Griffin that Kandahar, Cabul, and Herat should all be occupied by our troops. But those who are aware what forces we have at our command in India at the present moment must know perfectly

well that they are only just sufficient for the mere garrison work of that country; and that if we were to advance to fight the Russians at Kandahar, or, as I believe would be absolutely necessary, somewhere between Kandahar and Herat, it would mean that we should have to denude our Indian Empire of nearly all its fighting men, and should leave behind us those numerous elements of intrigue and disturbance which always constitute a real difficulty in India, and which, if uncontrolled and unchecked, would prove a very serious danger in the event of any rumoured misfortune to our arms. My objection to a forward policy, as it is called, viz., the occupation of Kandahar, was based primarily upon the fact that our Indian army is not sufficiently strong to take and occupy that advanced post; and secondly, because, in the event of Russia advancing upon India through that country, we should have the Afghans as our bitter enemies. We should thus not only have the disadvantage of fighting the Russians at a point far advanced beyond our own frontier and our primary base, but we should have also a formidable irregular foe, threatening our advance and harassing our line of communications the whole way from the Indus to Kandahar.

LORD NAPIER OF MAGDALA: I quite agree with my gallant friend Lord Chelmsford, that the army of India is only sufficient to do its work; yet we must remember that during the Indian Mutiny we had 100,000 British troops in India; and we do not expect to make a great war with a peace establishment. Of course, having got Great Britain at our back, we hope on any occasion to be able to find a sufficient number of Englishmen to meet the enemies of India.

SIR FREDERICK HAINES: My friend Sir Lepel Griffin has told us that Russia is not likely to attack Herat. I have watched Russia since the year 1848 very closely, and I have noticed that what Russia desires in the East she generally obtains. Want of money will not prevent her, troubles at home will not prevent her; for Russia can always get money for aggressive purposes; latterly perhaps you may have seen the great success with which she has floated a large loan in Europe. Want of means and her internal dissensions have always been considered a bar to Russia's advance in Central Asia; practically they have not proved to be so. My opinion is that Russia *will* attack Herat and will occupy Herat, and that she is preparing to do so at the present moment. I was unfortunately late in coming to the lecture, and had not the advantage of hearing the early portion of Sir Edward Hamley's very able address, but I am bound to admit that what I did hear I most thoroughly agree with. I am not aware if in the early part of the lecture Sir Edward touched upon the amazing power of Russia in her means of communication from the very heart of her provinces with the Transcaspian province. The Transcaspian province is to the east of the Caspian Sea, and has not, and never has had, connection with Turkestan. It is altogether separate, and has been either under the orders of specially selected Officers or under those of the Viceroy of the Caucasus; the Grand Duke Michel when holding that position meddled considerably in Transcaspian affairs. The power of Russia to transport from the central provinces is enormous by the Volga. It has always been so, but it is only recently that the shipping power of the Caspian has been so enormously increased, and that is for the purpose of meeting the necessities of the great oil trade of Krasnovodsk and its neighbourhood. They have built special steamers for this purpose: I believe they were built in St. Petersburg, and transported in pieces to the Caspian Sea, and at the present moment they are able at a trip to transport across the Caspian 8,000 men. I need not tell you that the Volga will send troops by steamer and canal almost the whole way to the Caspian. They have a bad embarkation at the Caspian because the mouth is so silted up that they have to use barges, but that is a small impediment to a military movement. The route from Odessa across the Black Sea to Batoum, that splendid port which we gave up to them at Berlin, for men and material, will be their main line of communication. The communication is now perfect between Batoum and Baku, and consequently with this large fleet on the Caspian their power is infinitely greater than it was four years ago when we gave up Kandahar. I maintain that this is a very important feature in considering the probability of a Russian attack on Herat, and the probability of something very startling being done which Sir Lepel Griffin does not seem to anticipate. Then, in addition to this power, you are aware that they have constructed a railway from

Michaelovsk to Kizil Arvat, and in 1881 they had reached Bami with a tramway; I think they are far beyond Bami now with their tramway. They are most probably at Geok Tépé; they may be on the Tejend—who can say they are not?

Mr. CHARLES MARVIN: Having recently returned from the Caspian, I may state that the railway does not extend beyond Kizil Arvat.

Sir FREDERICK HAINES: I referred to the tramway.

Mr. MARVIN: The tramway extended to Bami, and it was afterwards taken up.

Sir FREDERICK HAINES: I am glad I made the remark tentatively and subject to correction, for there are only a few men fortunate enough to have been in that part of the world, and can tell us anything about it as eye-witnesses. I am delighted that this very important subject has drawn forth so much intelligent criticism, and aroused so much interest; I am quite sure that if the British public only knew the vast importance of the subject we should hear a great deal more about it than we do.¹ As to the question of a frontier line as shown on one map, and to be shown on another, I hope Sir Henry Rawlinson will not think me rude in making a remark. The question of the action of the two offices in St. Petersburg is not new. That is the way in which they manage things there. One of the offices is prepared to disclaim the works of the other, still the works of the other invariably hold good, and will remain. We all remember the case of Geok Tépé. In fact at every step they have taken in Central Asia there was one office to protest that the other had done a thing which was not authorized. Still the aggression was maintained, and the conquest was held. It was so at Geok Tépé, and it will always be the same. In fact, Sir Henry Rawlinson's last remark somewhat reminded me of the two Sarakhs of which we have recently heard in the House of Lords.

Sir LEPEL GRIFFIN: I should like to make an observation in reply to Sir Frederick Haines, whom we are all glad to see back again in England. When I said I did not think that Russia would be likely to take Herat, I assumed that the English Government would be possessed of common honesty, courage, and energy. If the Government be not possessed of these qualities, I believe that Russia will certainly take not only Herat, but Cabul and Kandahar.

Sir FREDERICK HAINES: What symptoms are there that we can trust to anything of the sort?

Sir WILLIAM FRASER: I venture to ask Sir Edward Hamley whether he will think over some means of bringing this most important subject more largely before the public of this country generally. We know his consummate skill, and if he would use his gifts as a brilliant and successful writer for this purpose, he will be doing a great deal of good.

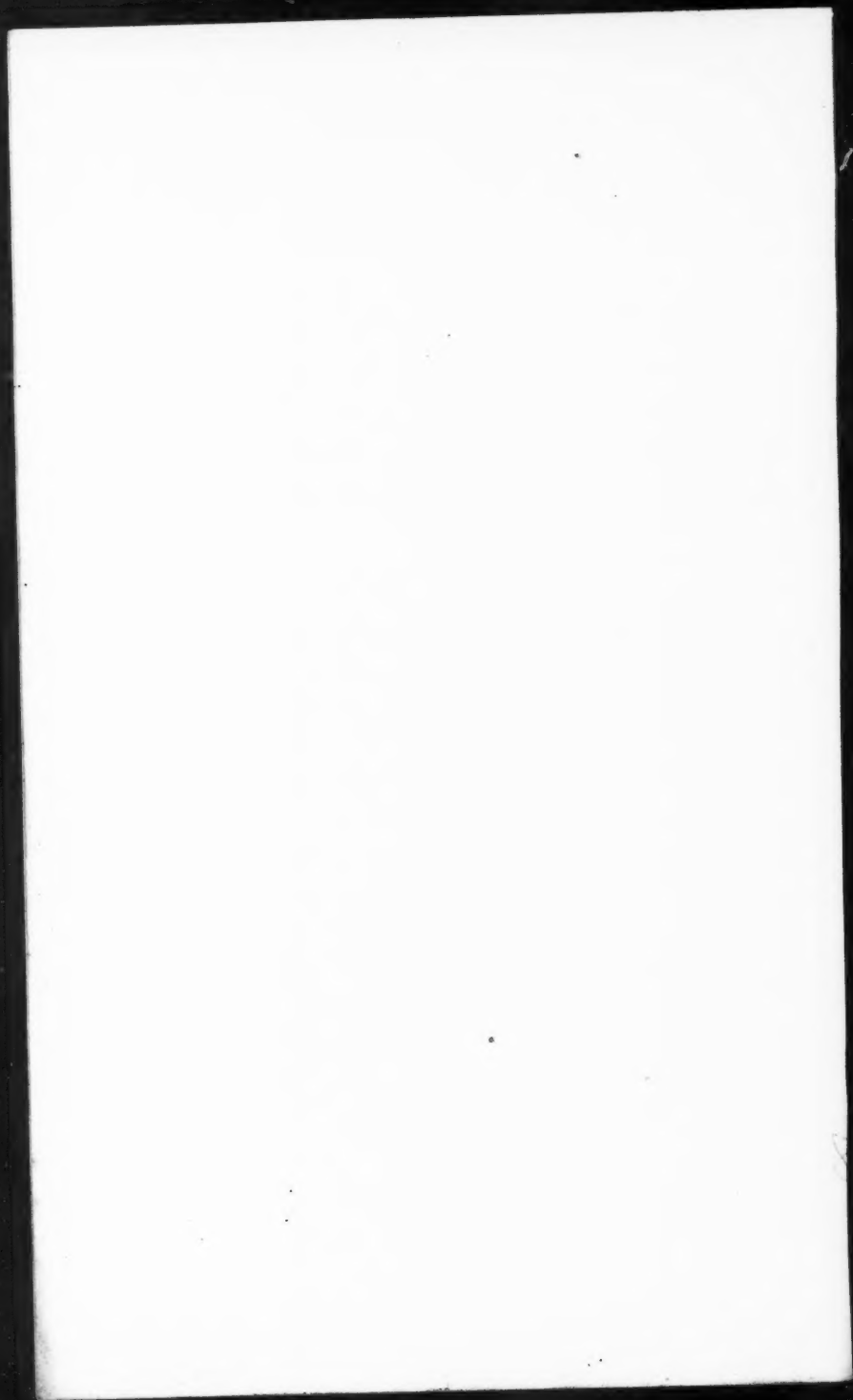
Sir ROBERT MICHEL: Allow me to express my agreement with General Hamley's lecture. If there were more unanimity of opinion in regard to the Russian designs in Central Asia, such as might be brought about if we properly judged of past events, there would be no two opinions of the strategical question as to the line of defence to be adopted.

Sir EDWARD HAMLEY: I believe it is customary for the lecturer to close the discussion with a few words in reply. First let me thank Sir William Fraser for the kind and flattering suggestion that he has made. With regard to the remarks of my friend Lord Chelmsford, I fully appreciate the force of his objection to the proposal for the occupation of Kandahar and of the territory beyond, as set forth in my lecture, on the ground that the means for effecting it do not at present exist. But I expressly stated that I offered it to you as an abstract military plan. I am aware that the forces available do not admit of its being carried out at present, but it was my hope that here might be originated a state of feeling which would cause an augmentation of these forces, in which case I am happy to perceive that Lord

¹ This subject has its commercial as well as its military aspect; for the manufactures of Birmingham, Sheffield, Manchester, &c., are excluded from the markets of Central Asia, and will be equally excluded from those of Northern and Eastern Persia. Indian trade suffers equally with British from prohibitive duties—all access to Bokhara, Samarcand, &c., is denied to Indian teas.—F. P. H.

Chelmsford will no longer find reason to object to the plan. As it does not fall within the scope of this lecture to enter much into details, I will not prolong the discussion. I will only say that my ultimate object will be fully answered if I succeed in arousing, in any degree, public opinion upon this important subject, and you will all agree with me that the immediate object is more than answered in the fact that the lecture has elicited the expressions of opinion from the great Indian officials present, than whom I know not where to look for a more brilliant assemblage of men entitled to speak with authority on the subject. I desire further to express my gratitude to Sir Frederic Goldsmid for filling the chair, and giving us the advantage of seeing amongst us one so learned in all the wisdom of the East.

The CHAIRMAN: At this late hour—for we have exceeded our usual limit—I do not propose to detain you with any remarks of my own; and I am sure they would fall very flat after the interesting matter you have heard not only from the lecturer but from Lords Napier and Chelmsford, Sir Henry Rawlinson, and others. I can only say that if my opinion were asked at all upon this great question with reference to Kandahar, I should simply speak as I spoke some years ago, on the losing side. Before we separate, however, I am sure you will all agree with me that our warm thanks are due to General Hamley for his most interesting lecture. It is not an ordinary paper that he has read, but an extraordinary one, and I can only hope that he will again favour us in the same way.



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